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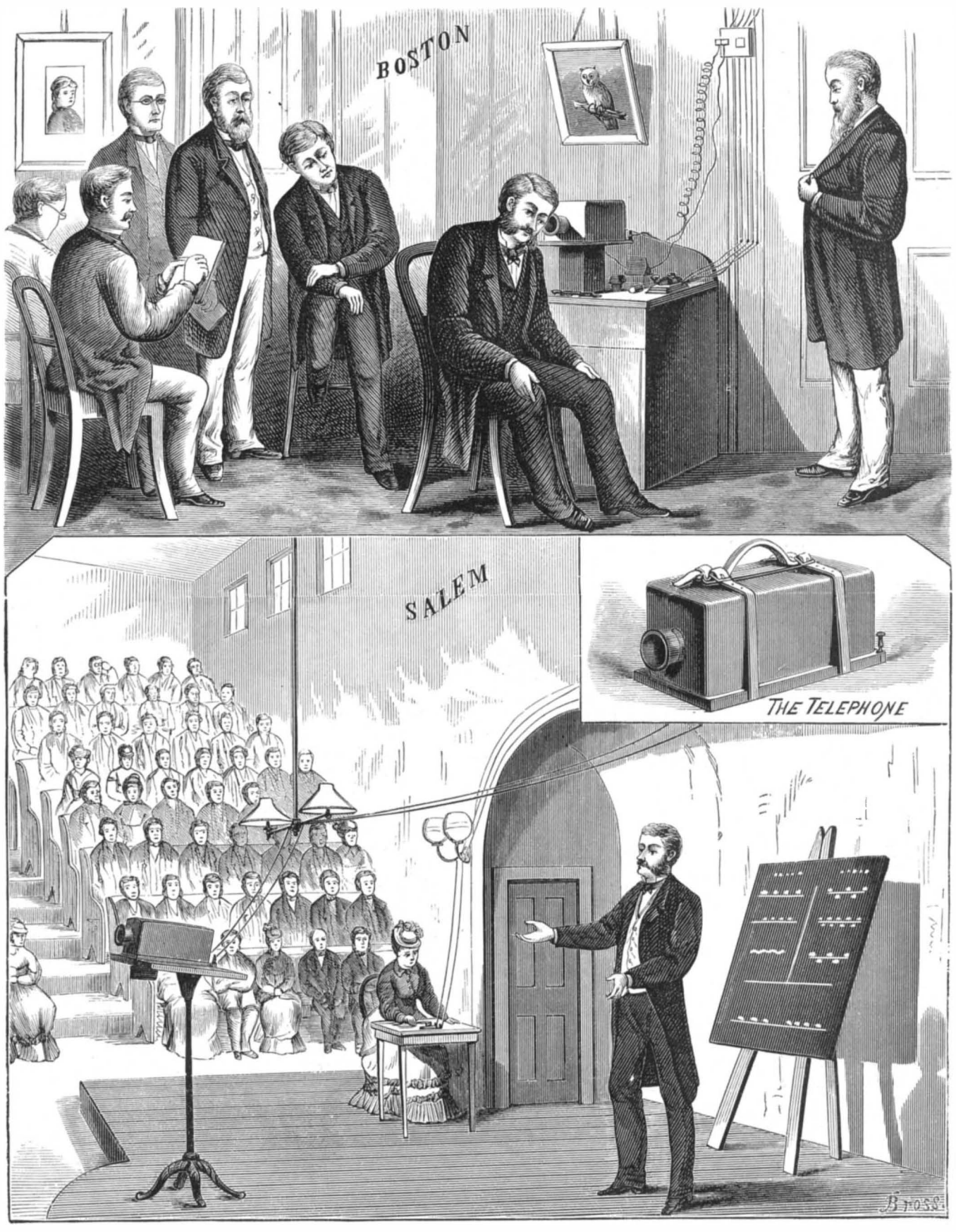
THE TELEPHONE.

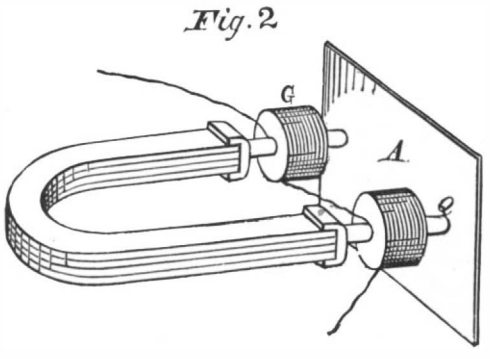
We have already laid before our readers accounts of the wonderful performances of Professor Bell's telephone, an instrument remarkable not merely for its phenomenal capabilities but also because of its having been brought to its present stage of development within the period which has elapsed since June last. During that month, Professor Bell exhibited the apparatus at the Centennial, working it over short distances only, and causing it to transmit sound, which reached the opposite terminus very much diminished in intensity. Without undertaking to follow the inventor through his various improvements, it will suffice here to state that the telephone has recently carried the human voice over a distance of 143 miles (from Boston to North Conway, N. H.), so that ordinary conversational tones uttered at one end were distinctly audible at the other. Further even than this, the inventor and his assistant have talked through a wire arranged to give an artificial resistance equal to 40,000 ohms, which is more resistance than the entire length of the Atlantic cable would offer. There are, however, other obstacles than the resistance, which checks the transmission of the voice over such immense distances. These the inventor is now endeavoring to overcome; and at the first favorable opportunity, a practical test of the powers of the instrument over one of the transatlantic cables will be attempted.



PROFESSOR A. GRAHAM BELL'S TELEPHONE.—Fig. 1.

In the telephone which we illustrated recently in the SCIENTIFIC AMERICAN SUPPLEMENT, a battery current was directly employed. The most important improvement yet made in the apparatus is the entire abolition of the battery and electro-magnets, and the substitution of the permanent magnet, the electric wave used in transmitting the sounds being generated by the voice itself. The construction of the instrument will be readily understood from the detailed drawings, Figs. 2 and 4. A, Fig 2, is a plate of iron or steel which is fastened to the sounding box, D, Fig. 4 (see page 200). E is the speaking tube by which sounds are conveyed to or from plate, A. F is a bar of soft iron or magnet; G is a coil of insulated copper wire around the extremity, H, of said bar, and I is an adjusting screw by which the end, H, may be placed as desired in relation to plate, A. Several of these instruments are placed at different stations upon a line as represented in Fig 3

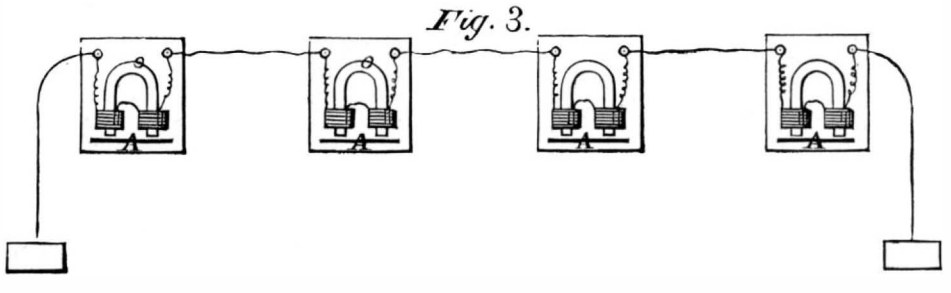
Fig. 2



When sounds are made at the mouthpiece of the instrument, the plate, A, is set in motion before the poles of F, which may be a permanent compound magnet and arranged as shown in Fig. 2. A current of electricity is thus created in the coils, G, surrounding the poles, and the duration of the current of electricity coincides with the duration of the motion of the plate as it vibrates. When the human voice causes the diaphragm to vibrate, electrical undulations are induced, in the coils around the magnets, precisely similar to the undulations of the air produced by the voice. The coils are connected with the line wire, and the undulations induced in them travel through that wire; and passing through the coils of another instrument of similar construction, they are again resolved into air undulations by the diaphragm, A, of the second instrument. So perfectly is this resolution effected that even a whisper is audible over long distances, and soft tones are even more distinct than loud ones.

It will be evident that it is possible to send by the telephone multiple telegraphic messages or multiple verbal communications simultaneously. In Fig. 3, we have represented a number of telephones connected together, each one, for instance, at a different station, the stations being several hundred miles, perhaps, apart. To send multiple telegraphic messages, let it be supposed that a certain musical sound is uttered before the telephone No. 1: then telephones Nos. 2, 3, etc., will all repeat that sound. Now let two musical

Fig. 3.



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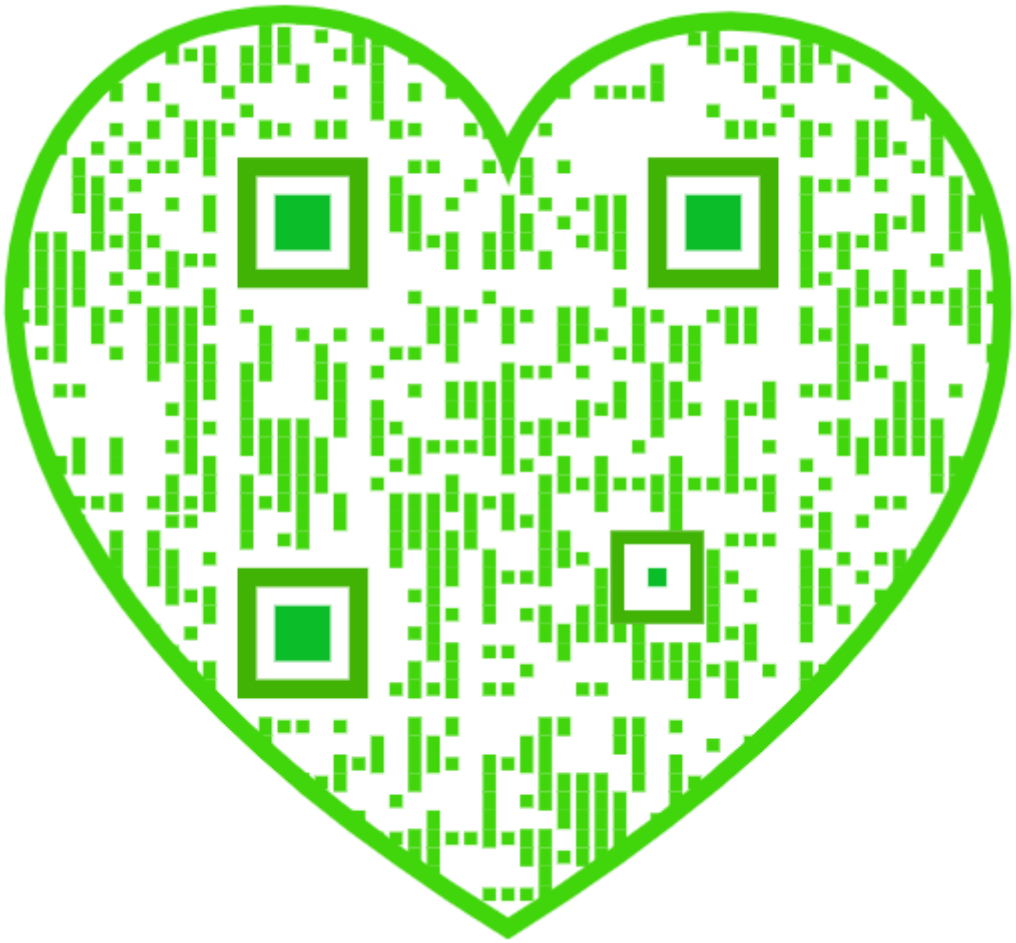

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OUR NATIONAL TRIAL AND ITS RESULTS.

The four months beginning November 7th, 1876, and ending on the 4th of March, 1877, will long be remembered as a period not only of severe trial to our national institutions, but also to the material interests of the country. The crisis has been passed, and there can be no question but that the new start is taken under better auspices than have obtained for many a year.

We believe that the revival in business activity is one that is going to make itself rapidly felt. Material for manufacturing purposes is comparatively cheap, building can be much more inexpensively carried on necessaries of life and wages are down, and altogether conditions are favorable for the undertaking by capitalists of enterprises contemplated, but long delayed, and for the investment of a vast amount of capital which hitherto has been closely guarded.

We are beginning to learn, moreover, that, after all, the hard times have not been destitute of good. As soon as the first effects of the blow had passed, manufacturers began to adjust their business to the new order of things. Cotton fell in value, and old stocks were, as already noted, cleared out under enforced liquidation. Meanwhile in the production of cotton goods we made numerous valuable improvements, and all this tended toward rendering us consumers of fabrics produced at home, rather than purchasers from England, as we had been to a large extent before. The same is true, though in smaller ratio, of woolen and worsted goods. The decline in our imports from England during the five years from 1871 to 1876 is shown in the following figures: Cotton goods from 129,700,000 yards to 55,000,000 yards, woolens from 5,391,000 yards to 1,478,000 yards, and worsted from 86,682,000 yards to 41,079,000 yards. Not only, however, is the market here for English fabrics substantially lost, but our manufacturers are entering into competition with British producers on their own soil. We have already a considerable trade in Manchester (the home of English cotton weaving) in cotton calico cloths. Our cotton mills have large South American orders on hand; and it is well known that we are now making worsted goods of better quality than the foreign fabrics we have hitherto imported.

On the other hand, during all the long period of depression, our exports have been steadily increasing. Fresh American meat, which bids fair to be the staple of a great foreign trade, is now sold throughout Great Britain at 16 cents and less per pound, or one quarter less than English meat. More than forty-four per cent of the foreign wheat required by England to eke out her home supply, we furnish. The shipment abroad of American lobsters and oleo-margarin oil are two new experimental additions recently made to our export list, both of which are promising. Our butter and cheese exports are exceedingly large and still growing. In brief, and without entering into further detail, our export trade (we quote figures obtained by the New York *Sun*, and embodied in a very carefully prepared article) for December, 1876, was by far larger than ever was known in one month, and the lessons of thrift and frugality which the business stringency has enforced are known by their fruits in the statement that the exports of 1876 exceeded those of 1872 by $171,000,000, while the excess of exports over imports for 1874, 1875, and 1876 amounts to the grand showing of $314,884,000.

We have before us a large number of reports from various sections of the country, all of the most encouraging nature. In New England, mill after mill is resuming full work in the iron trade of Pennsylvania, where the greatest stagnation has reigned, there are good signs of improving business; the shoe and leather merchants announce better sales; and altogether, look where we may, either the actual opening of augmented trade or good prospects of activity near at hand are clearly apparent. Even the blue glass mania has contributed its share to the general revival, as it has brought large business to our glass works, and has caused the production of a variety of glass which hitherto we have imported almost wholly from Europe. In fine, we have passed through the fire, not unscathed, it is true, but strengthened and chastened. The future opens hopefully. The characteristic energy of our people may be relied upon to render its years those of plenty, prosperity, and peace.

THE ASHTABULA VERDICT.

The verdict of the coroner's jury, relative to the terrible accident at Ashtabula bridge, accords with the popular verdict reached some time ago. The substance of the finding, which is based on investigations conducted with great thoroughness and by a body of men well versed in the technical subjects laid before them, is: First, that the bridge fell because of its own inherent defects, and second, that the subsequent burning of the train was owing to neglect to comply with the Ohio State law which provides that railroad cars shall be so heated that the fires shall be extinguished if the cars leave the track. This obviously places the whole responsibility on the shoulders of the railroad company; and it remains to be seen whether the fact of the latter's being a corporation is sufficient to shield it from the punishment deserved.

The bridge was unsafe, it appears, for eleven years. The man who designed it is dead, and the engineer in charge, who ought to have found out the defects, has perished by his own hand. Criticism of the direct agents is therefore silent. As regards the railroad company, the absence of the necessary precautions against fire can only be attributed to that spirit of parsimony which is altogether too prevalent among corporations when the question of using or not using the improved devices, which are constantly being invented, comes before them. It is the same spirit which causes steamship companies to send vessels to sea without proper life-saving apparatus—the same that begrudges the room in public buildings necessary for the construction of broad and ample staircases and other ready means of escape in time of danger. It is a peculiar phase of human nature, doubtless, that prevents the necessary outlay for such purposes; and people will keep on in the same course as long as they think they make money by thus saving, which is questionable policy when life is at stake.

IRON FRONT BUILDINGS.

A fire recently occurred in this city in a magnificent-looking building, which left the edifice a total wreck and resulted in the destruction of over a million dollars' worth of property. The structure was quite lately built, and had an ornate iron front, which gave it an exterior appearance of stability and solidity of construction.

There has been a predilection for exactly this species of building in New York and other cities, of late years, because it affords a great deal of show for little money. We do not doubt but that excellent materials are used by excellent architects in their construction. The difficulty lies not so much in the structures themselves as in the law which permits their existence, for it is not to be expected that while a handsome building can be cheaply erected without infringement of law, and readily insured, landlords will subject themselves to any extra expense in the matter. The question is one for the legislators, and it certainly seems to us that either laws forbidding the construction of any but really fireproof buildings in cities should be enacted, or else that existing statutes should be so modified as to prevent the erection of edifices which are so easily burned as the kind to which we have reference. We can recall over a dozen structures even larger than the one now destroyed, the progress of construction of which we have watched with apprehension lest they might tumble before completed. We have seen the thinnest brick walls erected to support a wilderness of wooden beams and partitions, the whole run up so quickly that the structures, before the façades were in place, reminded one of gigantic birdcages. Then the ornate cast iron fronts were added, bit by bit; and in an incredibly short space of time the birdcages were hidden, and elegant architectural creations, with richly decorated columns and ornamental window caps and cornices, and finally dazzling with gilding and paint in many colors, presented themselves to the admiration of all who did not know how frail was the backing of these gaudy exteriors. To make matters worse, there is a mistaken, though none the less prevalent, idea that an iron building is necessarily fireproof. An edifice wholly of iron of course would not burn; but we doubt if even such a structure would maintain its integrity long with a fire among combustible materials, like cotton and other fabrics common in our drygoods stores, on one of its floors; and this for the reason that iron speedily expands and warps with the heat. But buildings wholly of iron are few; and what is generally understood by an iron building in these days is one with cast iron front and iron columns supporting wooden beams inside. The beams and the contents of the structure burn readily; and the iron columns, as soon as they are heated, bend out of shape, and release the wooden beams, which tumble in a mass and, with the burning goods, increase the conflagration, while the plates on the front curl up like shavings.

We would not make a sweeping condemnation of iron fronts in general, because we believe that they may serve an admirable purpose in spreading good architectural designs at moderate cost; but it is the poor and inadequate material behind these ornamental fronts, which their beauty conceals and renders deceptive, which we condemn. Back an iron front with good and well laid brick and stone, and a substantial structure is accomplished.

THE THEORIES OF LIGHT.

Among the generally received theories of light, there are only two which possess any degree of probability: the corpuscular theory of Newton and the undulatory theory of Huyghens. The idea of the ancients that, in seeing, something goes out of the eye to the object seen, and the theory of Euler (who, by the way, was blind) that we see by induction, and that visibility is transmitted without the necessity of any intervening medium, in the same way as gravitation, are so imaginary and so thoroughly disproved by facts that they do not deserve any consideration.

Newton's theory, as is well known, consists in the assump-

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tion that luminous bodies are continually throwing out infinitely small and imponderable corpuscles, which, being propelled in all directions and in straight lines, on reaching an eye make the object visible. When applying this theory to the facts now known, grave difficulties are encountered; and the French philosopher Biot devoted nearly his whole life to the explanation, according to this theory, of the various phenomena of reflection, refraction, polarization, etc. He often had recourse to the most ingenious and intricate mental devices. The fourth volume of his "*Traité sur Physique,*" an octavo book of 600 pages, entirely devoted to the subject of polarization of light, as far as its phenomena were known in the year 1810, is a lasting monument of wasted ingenuity, as this whole theory was utterly upset by the phenomena of interference, which definitely established the undulatory theory, and this theory is further being confirmed by the details of spectroscopic observations at the present day.

This undulatory theory, as defended by Young, Malus, Fresnel, Brewster, and others, consists in the assumption that light is transmitted by undulations or vibrations in some medium, without the onward progress of anything, in the same way as the transmission of sound takes place: with the difference, however, that in sound the undulations take place by longitudinal compressions and expansions of the air: that means that the sonorous masses have their motion in the direction in which the sound is transmitted, while in light the undulations in the transmitting medium take place transversely to the direction of the ray. Some of our philosophers are dissatisfied with this theory. Thus, for instance, Professor Silliman, in his "Physics," says: "It is difficult to explain all the phenomena of light even on this theory;" and further on he closes some paragraphs, under the head of "No Theory of Light entirely Satisfactory," by stating that certain objections to the undulatory theory have as yet not been satisfactorily answered. Other writers express themselves in the same strain; but we may as well object to the undulatory theory of sound (of the correctness of which there cannot possibly be any doubt) on the ground that some difficulties have not yet been satisfactorily answered. In fact, in the case of sound, we have even more complexity than in that of light, as various rates of velocity produce pitch in the first and color in the second, and degrees of amplitude of vibration produce in both various intensities; and in both time is needed for the propagation. It is true that light moves in the planetary space one million times faster than sound travels in air; but both need time, and in neither of them is there such a thing as an instantaneous transmission, as is the case with the transmission of gravitation. In both, the phenomena of reflection, refraction, and interference may be observed; and further, the rays of either propagate and may cross each other in all possible directions without the least mutual interference. Various other similarities may be cited; but then, in sound we have the range of nine or ten octaves, while in light we have only one, or at most three, if we consider the heated and chemical rays at the respective extremities of the spectrum as two octaves. And in sound, we have difference in character, independent of velocity and amplitude, namely, that which the French call *timbre,* a peculiarity which is unknown in light, and is exemplified in the sounds of various musical instruments, voices of singers, etc., which differ from each other so plainly that each may be recognized even in a full orchestra and chorus. The familiar voice of a friend may be identified even among a great number of voices singing together in a choir. If we consider that all these vibrations not only differ in velocity and amplitude, but also in a multitude of other ways, of which the nature is as yet a mystery to us, and reserved for future study, and that all these are transmitted simultaneously without interfering, not alone through air, but may be even transmitted through solid rods, we are startled at the complexity of the nature of the form of all these various sonorous waves; and we may with good authority state that many difficulties in acoustics have not yet been satisfactorily explained by the undulatory theory of sound; but nobody has for that reason ever asserted that the undulatory theory of sound is not satisfactory, because it is established beyond the shadow of a doubt, and any other acoustic theory is absolutely impossible.

We may therefore safely maintain that any remaining difficulty in the explanation of the phenomena of light is due only to our imperfect knowledge of the nature of the various possible kinds of vibrations, which are often of the utmost complexity. Mathematical investigation has already done a great deal in this direction, and promises to do a great deal more. The labors of Lissajou in the determination of various sound curves, and the resulting pendulum apparatus to delineate them, called the sympolmograph, is a move in the right direction, and the prosecution of such labors will no doubt enable posterity to explain clearly much that is as yet a mystery to us.

In this connection, we ought to mention the modification the undulatory theory proposed by Rankine. He assumes that the particles of the medium which transmit the light (whatever that medium be or may be called) rotate on their axes by the action of a kind of magnetic polarity. This theory is intended to overcome the difficulty of assuming that the light-transmitting medium has the properties of an intensely elastic body, or, as Tyndall expressed it, is, in a certain sense, as dense as a jelly. The beauty of Rankine's hypothesis is that the same mathematical formulæ may be employed as for the other form of the undulatory theory, which is a strong argument in its favor.

PHOTOGRAPHS IN THE EYE.

There has long existed a popular superstition that the human eye after death bears the picture of the scene on which it last gazed. Abundant romantic stories are current of how murderers have been recognized through the imprint of their features on the pupils of their victims; and not very long ago many believed that a substantial proof of the supposition had been afforded by the eye of a murdered man, whose body had been found under a hedge, exhibiting a ramified appearance, a likeness between which and that of the tangled branches above the organ some imagined they could trace. It is certainly startling to meet with the grave assurance that the above superstition, although not literally true, possesses a very strong foundation in fact; but the recent wonderful discoveries of Drs. Boll and Kuhne leave no reasonable doubt but that our retinas are sensitive photographic plates, inasmuch as they contain a substance which, under the influence of light, undergoes chemical changes which vary in intensity according to the intensity and character of the luminous rays.

Not very long ago Dr. Boll, Professor of Physiology in Rome, directed the attention of the Berlin Academy to the curious fact that the external layer of the retina, which the microscope shows to be made up of rods and cones, is in all animals of a purple color. This color, he pointed out, is during life being constantly destroyed by the light which enters the eye. Darkness, however, restores the color, which vanishes for ever almost immediately after death.

The very remarkable nature of these statements induced Dr. Kuhne, Professor of Physiology in the Heidelberg University, to undertake a repetition of the experiments; and the results of his researches he has lately communicated in a paper addressed to the Heidelberg *Natur-Historisch Medici isches Verein.* Kuhne's observations were made upon the retinæ of frogs and rabbits; and by examining as soon as possible after death the retinæ of animals which had been kept in darkness, he found "that the beautiful purple color persists after death if the retina be not exposed to light; that the bleaching takes place so slowly in gaslight that by its aid the retina can be prepared and the changes in its tint deliberately watched; and that when illuminated with monochromatic sodium light, the purple color does not disappear in from twenty-four to twenty-eight hours, even though decomposition has set in." These facts, obviously going to disprove one of Boll's important statements, at the same time removed many difficulties of investigation; and Dr. Kuhne, carrying on his researches by the monochromatic light of sodium, proceeded to investigate the conditions necessary to the destruction of the vision purple (*Sehpurpur,* as he terms it), as well as some facts relating to its restoration or removal. These observations yielded the discovery: first, that, under yellow light or in the dark, the retina may be dried on a glass plate without its color changing; second, that the color is not destroyed by strong solution of ammonia, saturated solution of common salt, or by maceration in glycerin for 24 hours. On the other hand, it is destroyed by alcohol, glacial acetic acid, strong solution of sodium hydrate, or a temperature of 212° Fah. It was also determined that the more refrangible rays of the spectrum have the greatest influence on the color, while red light is as inoperative as yellow light.

Dr. Kuhne next showed that, even after the living eye had been exposed to daylight, its retina, on being examined in the sodium light room, still showed a fine purple, thus negativing another of Boll's assertions; while he further noted that the fading of the purple occurred only after the eye had been exposed for some time to sunlight. The curious result was also reached that, while a retina removed from the eye lost its purple color under diffused daylight, another retina, left in the eye but exposed by an equatorial section, turned a dark red, which bleached when the retina was exposed in naked condition to the daylight. A still more remarkable experiment was that showing how the vision purple is restored. On making an equatorial section through a recently extirpated eye, and lifting a flap of retina from the underlying choroid so as to expose the flap to the light, the purple color of the flap was found to be destroyed, while the color of the rest of the retina persisted. But on replacing the flap, a complete restoration of the vision purple occurred. Dr. Kuhne concludes, therefore, that this restoration is a function of the living choroid, probably of the living retinal epithelium; and it appears to be independent of the black pigment which the retinal epithelium normally contains. Thus, not only does the retina contain a substance capable of being acted upon by light, but connected with it are structures which, so long as they are alive, are able to provide fresh stores of sensitive material.

After concluding this first series of researches, Dr. Kuhne endeavored to obtain, on the retinæ of freshly killed animals, images corresponding to objects looked at during life. And he showed that, in order to obtain a permanent photograph or, as he terms it, an *optogramme,* the effect of the light would have to be so prolonged or so intense as to destroy the balance between the destruction of the vision purple and the power of the retinal epithelium to restore it. In order to test the matter thoroughly, he fixed the head of a living rabbit, so that one of the eye balls would be 58·5 inches from an opening 11·7 inches square in a window shutter. The head was covered for five minutes by a black cloth, and then exposed for three minutes to a somewhat cloudy sky. Instant decapitation was then effected, and the eyeball was rapidly extirpated under yellow light and plunged in a five per cent solution of alum. Two minutes after death, the second eyeball, without removal from the head, was subjected to exactly the same processes as the first, namely, to a similar exposure to the same object, then extirpation, etc. On the following morning, the milk-white and now toughened retinæ of both eyes were carefully isolated, separated from the optic nerve, and turned. They then exhibited, on a beautiful rose-red ground, a nearly square image, somewhat larger than 0·0016 square inch in size, with sharply defined edges. The image on the first eye was somewhat roseate in hue, but less sharply defined than that on the second, which was perfectly white. In brief, the hole in the window shutter was photographed on the rabbit's eye. What further investigations into this subject are likely to show, it is difficult to surmise; but it is certain that no results that may be adduced can be more astonishing or unlooked-for than those already reached. They bring out in the strongest relief the fact of how little we really know of our own organization; while they add to the already long catalogue of marvels pertaining to that most wonderful of optical instruments—the human eye.

AN EDITOR'S PERPETUAL MOTION.

Mr. Morgan, the editor of *The Phœnix,* a sprightly newspaper at Columbia, S. C., has invented a perpetual motion, which is to operate as follows: Upon the periphery of a large wheel are arranged a series of rubber bags, one half of which are filled with water. As the wheel rotates, the bags on one side of the wheel become filled with water, while the bags on the opposite side are emptied; a preponderance of weight being thus maintained on one side of the wheel, the latter will continue to rotate until something wears out, or the world comes to an end.

Mr. Robert Tozer, who, Mr. Morgan says, is one of the principal machinists of the place, has given a public certificate setting forth his belief in the practical success of the machine; and on the strength of this certificate Mr. Morgan has issued a very flattering financial prospectus. It is modestly headed "The Morgan Self-Producing Motive Power. No Fire! No Steam! No Explosions! No Engineer! No Expense! Nature's Forces Utilized! The Power that is to Revolutionize the World! There's Millions in it!"

To aid in procuring means to construct a working model, the inventor issues certificates of one hundred dollars each, payable at par as soon as success is insured and the money therefor realized. These certificates he is now ready to sell for one dollar each, or one cent for each dollar of their actual face figures. It is plain that Mr. Morgan is a better inventor than financier, or he would never have put his shares on the market at so low a figure. He evidently needs the assistance of an able person who has had experience in financing similar enterprises: like Mr. Charles B. Collier, for example, the learned agent for the Keely Motor Deception, who at one swoop drew in a hundred thousand dollars from New York merchants in payment for shares in that absurd bubble. Should Mr. Morgan be unable to secure the personal services of Mr. Collier, he may at least derive practical hints from a reading of Collier's own statement of the way he raised the wind for Keely, as published in the SCIENTIFIC AMERICAN, July 17, 1875.

THE COMMISSIONER OF PATENTS.

General Ellis Spear, the new Commissioner of Patents, has entered upon the supervision of the Bureau; high subordinate positions in which, he has already ably filled. Either on the principles of civil service reform, whereby long experience in a lower grade is deemed one of the best qualifications for advancement, or through his personal fitness for the office, General Spear's appointment meets approval of the country, while it is also one upon which we think all inventors may be congratulated. An inefficient or poorly informed commissioner has it in his power to impede the efforts of inventors through lack of a proper appreciation of the importance of their work; and thereby he may, however innocently, act adversely to the interests of that great class, and ultimately to those of the public. For this reason, the office should never be regarded in the light of a political emolument, but rather as a high honor bestowed on the possessor of the rare qualifications which should be brought to it.

We are satisfied that the selection of General Spear for the post is in the above respects a wise one; and it is to be hoped that he will regard the position as a trust, to be administered for a longer period than some of his predecessors have found it to their personal interests to do.

Poisonous Peas.

French canned peas are now so commonly sold by grocers that it is not at all pleasant to learn that in England some recent cases of poisoning have been traced to copper put in the cans in order to preserve that beautiful green color of the vegetable. There is not enough of the deleterious metal in any one can probably to do harm; but where the peas are used on the table regularly, an English chemist says, there is sufficient of the poison to affect the health seriously.

CANCELLING POSTAGE STAMPS.—J. C. E. writes to suggest that the government should stimulate inventors to produce an indelible cancelling ink by offering a reward for the invention.

WHAT IS SCIENCE?—"Science to the general public," says a witty contemporary, "is everything you can't comprehend: directly you begin to understand it, it ceases to be Science."

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RICE CULTURE IN CHINA.

The *Gardeners' Chronicle* gives a series of quaint illustrations from a Japanese work on horticulture and agriculture, recently exhibited at a meeting of the Royal Horticultural Society, London, by Mr. Moseley, one of the naturalists attached to the late Challenger Exhibition. We select one of these engravings for publication, in which the scene depicted represents the thinning out and transplantation of the rice plants in the flooded fields wherein it is cultivated.

The mode of culture of the rice plant varies considerably, according to the climate and local circumstances. The following is the method, says *Land and Water*, employed among the Chinese, who cultivate it to a very great extent in the midland and southern parts of their dominions, the low grounds of which are annually flooded by the Kiang and the Yellow rivers. These extensive inundations are occasioned by the heavy rains which fall near the sources of these rivers, which have their origin in the Himalayan chain of mountains.

When the waters have receded, the earth is covered with a thick coating of slime and mud, which fertilizes the ground as perfectly as the richest manure. As soon as this takes place, the patient Chinese surround portions of this rich soil with clay embankments, always selecting the neighborhood of some running stream. The ground is then carefully harrowed, and the operation is repeated until it works well. In the meantime the rice intended for seed has been soaked in water, in which a quantity of manure has been stirred; this has forwarded its growth so much that the young plants appear above the ground in two days after they have been deposited in the earth. It is necessary to remark that, during all the early stages of its growth, and until the seed is well set, the roots of the plants must be constantly under water; to effect this, different contrivances are resorted to, to keep up an adequate supply of water.

CULTIVATING RICE IN CHINA.

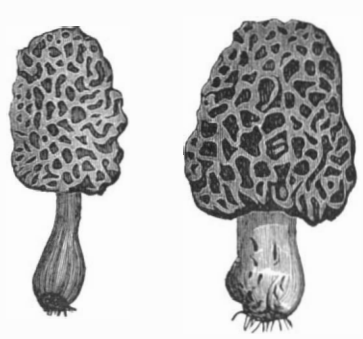
As soon as the young plants have reached the height of six or seven inches, they are pulled up, the tops are cut off, the roots carefully washed, and the whole planted out in rows, as shown in our illustration, about a foot asunder. In the course of its growth, it is sprinkled with lime and water, which is said to destroy insects and assist in enriching the soil; the greatest care is also taken to remove weeds by hand as fast as they spring up. In these tedious operations the English agriculturist can form no idea of the perseverance and attention of the industrious Chinese. The first crop, for they obtain two in the course of the year, is harvested about May or June, and the second in October or November.

The sickle employed by the Chinese for the purpose of reaping the rice is, like the European instrument, bent into the shape of a hook, but the edge, instead of being smooth, is notched like that of a saw. The straw and stubble left after the harvest are burnt on the spot and left to enrich the land.

MUSHROOMS.

To those living in the neighborhood of forests in Europe, especially in France, mushrooms form an important item in domestic economy. Being among the most nitrogenous articles of diet, they well deserve the name of "vegetable meat," which has been bestowed on them. We publish herewith engravings of three kinds of edible mushrooms, all well known in France, and which might be more generally introduced here to the great satisfaction of American epicures. The first is the *morille comestible*, the botanical name of which is *morchella esculenta;* the second is the cep, or *bolet comestible* (*boletus edulis*); and the third is the *chanterelle comestible* (*cantharellus cibarius*).

Fig. 1.



In examining these three specimens, we find, at the base of the stalk, some very thin filaments, which are commonly called the roots of the fungus, but of which the proper name is *mycelium*. These form the vital organs of the plant, and although the stalk and its burden soon perish when past maturity, the mycelium resists the frosts of winter and the summer's aridity. Recent investigations show that the fibers are not only the roots, but possibly also the flowers, of the plant. The stalk and the upper part correspond to the fruit, as their function is simply to carry the spores.

There is one fact which should be remembered by the lovers of mushrooms, which is that locality has much to do with the flavor of these *fungi*, and even with their fitness for food. The *agaricus campestris*, the common mushroom of this country and England, is rejected in the markets of Italy as unwholesome; while the chantarelle, a highly prized rarity in England and a favorite species in France, which is represented in Fig. 3, was not relished when found in North Carolina by Mr. Curtis. This writer states that he ate of 40 different species of *fungi* gathered within two miles of his house, and that he found 111 kinds in the State.

Fig. 2.

Fig. 3.

In cultivating mushrooms, it has been found that horse and cattle manure is the best substance for promoting the growth of the mycelium; the earth from the track of a horse power, in which the droppings have been thoroughly beaten into the soil, is excellent material. This should be made into bricks with a hole in each, in which a small piece of the spawn should be inserted; the bricks should then be placed in a hot bed and kept at a temperature of 60° Fah. till the whole mass is permeated by the threads of the mycelium; then further development may be stopped by drying the bricks, and they may be stacked away for use or sale. When the spawn is to be used, make a bed of horse or cattle manure, solid and large enough to maintain a heat of 70°; stick in bits of a brick of spawn at intervals. When the mycelium begins to grow rapidly, cover the whole with about two inches of mould, and place over it straw. The earth should be kept moist, warm water of 70° being used. Mushrooms will appear in six or eight weeks; and they should be twisted off the stalks with the fingers, and not cut off.

As light is not necessary to the success of mushroom culture, they can be raised in cellars or caves, such places being especially suitable because of their generally uniform temperature. Near Paris, France, immense numbers of mushrooms are raised in old stone quarries, two such excavations containing mushroom beds to the length of 16 miles and 21 miles respectively; and one of them sends 3,000 lbs. of mushrooms to market daily.

Scientific Lunacy.

The suicide of George C. Wheeler, a chemist, living in Dundee, Canada, is, says the New York *Tribune*, one of the strangest ever recorded. He was a hard student, 22 years old, who rarely went into society, but lived by himself, working in a small laboratory by day and watching the stars by night through a small telescope. About six months ago he told his friends that he had made a chemical discovery which would carry his renown to the ends of the earth. The hallucination which took possession of him was that he had succeeded in making a preparation which, when scattered on a dead person, would restore life. Neither the arguments nor jeers of his friends changed this belief. He resolved to kill himself in order to have the efficacy of his resurrection powder tested. In a letter which he wrote on March 3, he says: "My physical atomic state, after the ordeal, I desire shall be taken in charge by Professor McLouth of the State Normal School, who, taking a portion of my 'creative, all-changeful material assistance,' will scatter a few particles over the dissectary remains, and then place them in the receptacle of my 'galvanic, magnetic-electrical power,' when the elements will resolve themselves into a new combination, and I will appear a living evidence of the truth of this new discovery." A large bottle, containing a thin fluid, labeled "creative, all-changeful material assistant," was found beside the letter. The machine used by the young man to accomplish his purpose is a marvel of ingenuity. A stout wooden framework supports a large balance wheel, to which are attached knives, portions of scythes, and an ax head. Back of this there is a complex arrangement of small wheels and pulleys, all operated by a powerful steel spring. When set in motion the machine is capable of running at a frightful rate of speed for the space of ten minutes. Close by it is a three-sided trough in which he must have placed himself after setting the devilish arrangement in motion. His head, which he laid under the wheel, was mangled beyond recognition. When his body was found, his brains were oozing out of a deep cut in the back part of his skull.

Ewes' Milk the Richest.

Dr. Stevenson MacAdam, in a paper recently read before the Pharmaceutical Society of Great Britain, shows that ewes' milk is the richest by the following figures: Solids by weight in milk of town dairy cow, 12·27; country dairy cow, 12·77; goat, 13·43; ewe on natural pasture, 1 75, or, with addition of feeding stuffs, 26·11. Taking the fat in the solids in the order above mentioned, the figures are 2 58, 2·88, 4·31, 6·77, and 8·27.

THE London *Gardener's Chronicle* advocates the grafting of roses by the insertion of growing eyes in the early spring instead of dormant eyes in the summer. The growing eyes are inserted in the main stem, one on each side, to form symmetrical heads. These make as much growth in the first season as the dormant eyes do in the second season.

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PRACTICAL MECHANISM.

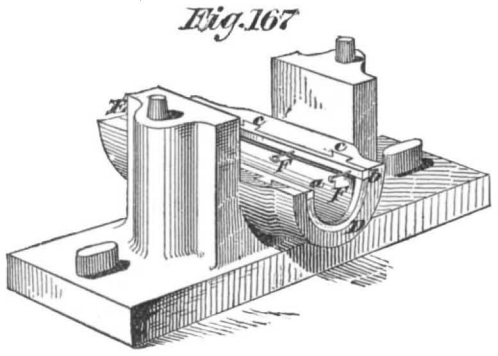
BY JOSHUA ROSE.

NEW SERIES—NO. XXIII.

BENCH WORK.

The method to be pursued to make the pattern for the brass is as follows: Take a piece of wood of sufficient size to form the body of the brass, and make it of the necessary size and form, observing the directions above given as to the bevels; and make the flanges by turning the two halves in one, as explained in a previous example, omitting to turn out the inside, as this would effect no saving, and such boring would weaken the flange and render it liable to split in attaching it to the body of the pattern. To fasten the flanges, glue them on; and when dry, insert brads, setting the flanges by lines. Then pare out the flange even with the bore of the brass. In many cases brasses are dispensed with, and Babbitt metal is employed in their stead. The requisite form of casting for this purpose is shown in Fig. 167, the Babbitt metal be-

Fig. 167



ing contained within the thin ridges which extend all around the edges of the half circular bearing. In addition to this, however, the machinist sometimes drills small holes in the cavity for the Babbitt metal. The ridges are cast solid with the box, and the two at the end (D and E in Fig. 167) make no difference to the moulding, since they will leave the sand readily and easily. But the ridges or strips that extend lengthwise of the bearing must be made detachable from the pattern, the strips referred to being held in position by the dovetails shown at C. The recesses to receive the dovetails are first cut out, and the dovetails are made to a neat fit therein. Then we take the strips required to form the ridges; and having just spotted the faces of the dovetails with glue, while they are in their places we press the strips against them for a moment, and adjust the strip and leave it in position, for the glue to dry. By this means the dovetails are fastened to the strips exactly in the required position. When dry, the strip with the attached dovetails may be withdrawn from the pattern, and should then be more securely fastened together by the addition of screws or nails. In many cases wires are employed in place of the dovetails; they are being inserted as shown in Fig. 167, at F; and when they are used, it becomes a consideration whether the moulder can conveniently extract them. If he can, they are preferable to the dovetails, as these latter are sometimes apt to stick.

Bearings of this class (Babbitt metal) are often formed in the framework of a machine, or in other patterns that do not permit of being moulded in the direction suitable for the above example. Fig. 168 represents such an example, which requires to be moulded in the direction denoted by the arrow. It will be advisable to core out the whole space for the cap and bearing, the core box in this case being fitted with the strips in a manner similar to that above described for the Babbitted pillow block. The pattern in this case is made as shown in Fig. 169, the space for the bearing being blocked up, and the block extending through, as shown at A, to form a core print. The core box shown beneath may be, in the smaller sizes, cut out of the solid wood, the part, B, being made thick because it includes the thickness of the ridge on that end, and also the depth of the print, as shown at A. The reason that the block or core print protrudes, at C, is that a ridge may be formed in the mould to steady the core while inserting it in the mould; and the depth of the core box, at E, must be made to suit it. It will be noted that the core prints, at F F, are carried to the top of the pattern; and it will be readily perceived that they must be so made in order that the pattern may lift from the sand. Then, after the mould is made, the core for the hole is first inserted, and then a small core is fitted into the recess in the mould, and thus is the top part of the recess (above the core print) stopped off. The circles marked on the faces of the prints, F, are to be painted on the pattern in black varnish, and their purpose is to denote that the core proper is round. If these black circles were not made, the pattern maker would require to make a similar circle and cross marks with chalk or pencil that the moulder may know how the core is to be left.

Fig. 168.

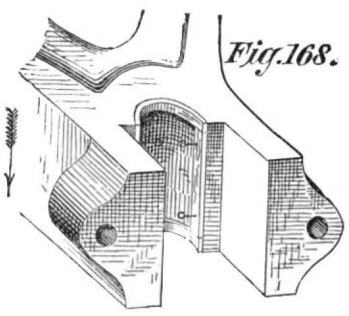


Fig. 169.

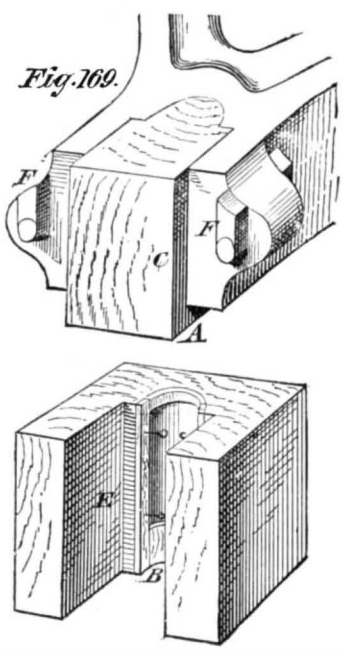
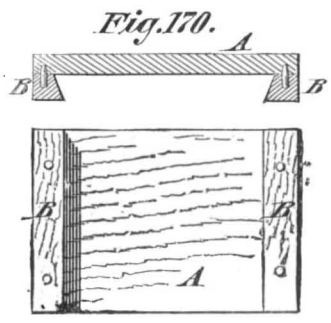


Fig. 170 is a representation of a pattern for a slide; it has the projections simply set on with pegs, to prevent the pattern being locked in the sand. In moulding this piece, a false core is laid between these projections. After the cope is lifted, the plate, A, may be taken out; and after removing the false core, the pieces, B B, can be withdrawn.

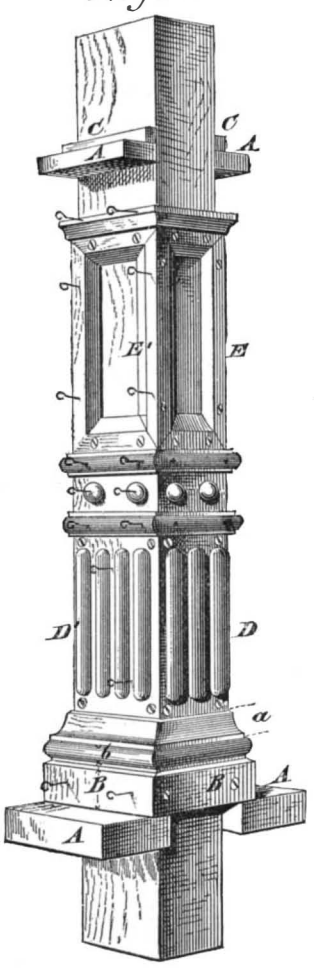
Fig. 170.



Our next example shall be for a square or rectangular column, which, though very simple in construction, yet necessitates a departure from the ordinary method pursued in pattern making, the object being to save the making of an entirely new pattern for every required column. In view of the thousands of columns of this kind that have been cast, it is not to be wondered at that measures have been taken to cheapen the cost of the pattern, and lessen the labor in preparing the mould; but it is to be remarked that no one has been able to invent a permanent mould for this class of work. In cast iron columns, the strict rules of architecture are not rigidly followed. The slight but graceful curve prescribed for every column and pilaster is frequently neglected, and various parts of the column are modified in their contour: to their detriment, as may be easily seen by comparing the details of a stone building with those of an iron one.

Square iron columns are usually made parallel throughout their lengths; while, on the end view, two of the sides incline towards one another on account of the draft or taper given to the pattern. Round column patterns are not made parallel, but are smaller at the cap than at the base. The curve above mentioned is given to the shaft; but as the pattern is made to serve for all lengths of columns of that diameter, the curve can only, in most cases, be an approximation. In foundries that make a specialty of this class of work, numbers of blocks of various sizes and lengths are kept, and they simply require the addition of such ornaments as the design comprises, which ornaments, such as mouldings, flutings, and the like, are often ready to hand to complete the column pattern. These blocks are, for small columns, made solid; but for large columns they are constructed like boxes or troughs, with pieces filled in at short distances to give strength. (See Fig. 172). Fig. 171 is a perspective view of a block, mounted with mouldings and other ornamentation so as to form a column pattern ready to go into the sand. The base, B, and its mouldings, *a* and *b*, are to be cast solid with the shaft of the column: this, however, as may be inferred from what has been said, is not compulsory. It will be seen that the base forms a guide for the stopping-off blocks, A A, at that end; at the other end of the column the guides, C C, are attached. The distance between the stopping-off blocks, A A, is of course the length of the column, *plus* shrinkage and *plus* the amount left for cutting off to square up the ends of the cast column. The wires shown are for the purpose of holding the ornaments in position upon the block. The ornaments on the face are held by loose pegs, except the cabling, D, and the paneling, E, which are made fast on the face by nails or screws.

Fig. 171.



Let it be required to prepare a pattern for a column 12 feet long, of 12 inches face, and 14 inches deep, to be of the style shown in Fig. 171. Select a block similar to that shown in Fig. 172, in which the top piece is shown removed so that the distance pieces may be seen. We will suppose our column to require mounting on the face and one side; then $\frac{1}{2}$ inch or $\frac{5}{8}$ inch will be taken up on the face and side by the margins, E, which form, with their mouldings, the paneling: therefore, if $\frac{1}{2}$ inch margins are used, the block

Fig. 172.

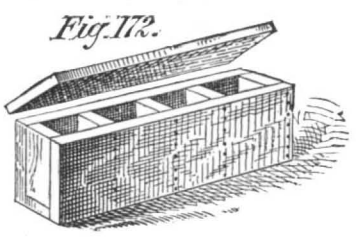
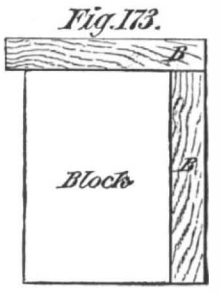


Fig. 173.



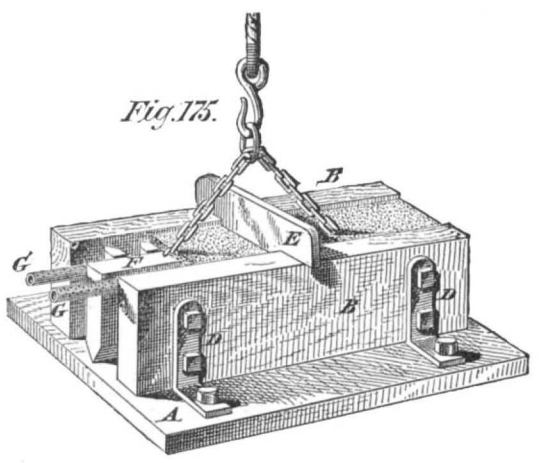
should measure $11\frac{1}{2}$ by $13\frac{1}{2}$ inches, and $\frac{1}{8}$ less if $\frac{5}{8}$ margins are employed. The length of the block is immaterial, so that it be not less than 20 inches longer than the column: this excess is for core prints at the ends of the pattern. Lay off upon the block the length of the column pattern; this will be 12 feet + $\frac{12}{10}$ inch for shrinkage + $\frac{1}{8}$ or $\frac{3}{16}$ inch at each end for squaring up. Space off upon the block the position of the various members and apply them as directed. It must be noted that the mouldings and base pieces on the face overrun those upon the side, and also extend according to their contour over the side that is not mounted (see Figs. 171 and 173). The reason of this is that by removing these face mouldings and base pieces, except the cabling and paneling (which are fast), the moulder can make a bevel parting. When the parting is made, the pieces are then replaced and will be taken up again by the cope. A rectangular column is invariably moulded with the face up, because of the facility such a position gives for supporting the main core by means of the cores which make the openings always formed at the back of these columns.

For stopping-off the column to the right length, we simply prepare four pieces, as shown at A, Fig. 171, of a length equal to the depth of the column at the ends, not including the base piece, as that will be stopped-off in the cope. In ramming up the column, when in the sand, these pieces are bedded in. in the position shown. Some provision is necessary to prevent them from being rammed out of the perpendicular; this is provided in this case by the base pieces, B; but at the other end of the column temporary strips are braded to the block, as shown at C. To find the place for these guiding strips, add to the length of the column pattern the thickness of the stopping-off piece, square a line at this point down each side of the block, and nail on the guides outside this line but with one edge touching it. Columns are often cast without bases or caps, these latter being cast thin and attached by screws after the columns are set up.

The ornamentation of columns is varied constantly, depending upon the taste of individuals; therefore it is impossible to lay down precise directions in this matter. It is thought, however, that the above remarks will be of service, and I may add that, in place of cabling, fluting is often employed. This is never to be cut out of the block, but formed in extra pieces. The cabling on the side is made by fastening the strips to a piece of board, and this is attached to the block by wires. Fig. 174 shows this arrangement. Baked or dry sand is not used for the main core of square columns, and we proceed to describe the method of making the greensand core now invariably adopted. Fig. 175 shows a sort of universal core bore, employed for making these cores. A is a cast iron plate, laid upon the floor of the foundry, generally in close proximity to the mould; upon this are set up two stout boards, B, about two

Fig. 174.

Fig. 175.



inches thick. These boards are adjustable, so as to take in any breadth of face, by the brackets, D, moving along slots in the plate. Nipping screws in the brackets admit of the boards being pressed together on the end pieces, which must be changed for every width of column; the height of the core is regulated by means of the strike, E. On account of the exceedingly fragile nature of a greensand core, it is necessary to imbed within it a strong bar of cast iron, called a core bar, such as is represented at F, Fig. 175. It consists of a strong center bar with pieces cast solid with it, ranged on each side, called wings; the bar itself is made to taper off to a narrow ridge towards the under part, as also are the wings, which taper at the edges. The sand, being rammed between these wings, is able not only to sustain itself, but

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also a small portion extending beyond them, namely, to the correct outline of the core. The bar is generally from half an inch to one inch smaller than the core, as will be seen in the sectional end view, Fig. 177. A notch is cut out of

Fig. 176.

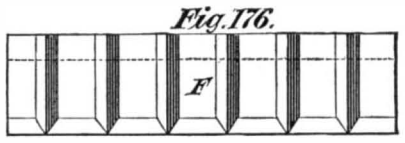
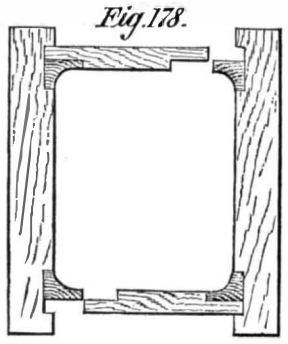


Fig. 177.

each wing to admit of the insertion of a perforated tube on each side for ventilation. The core bar, F, and the perforated tubes, G G, are shown in Fig. 175, imbedded in the core.

Fig. 178.



As there are not any core prints required to form the openings at the back of the column, the cores for these openings are made in a box not thicker than the intended thickness of metal in the column. Such a box is shown in Fig. 178, though, for the sake of cheapness, when the columns are not more than half an inch thick, the core box is sawn out of one piece.

Fig. 179.

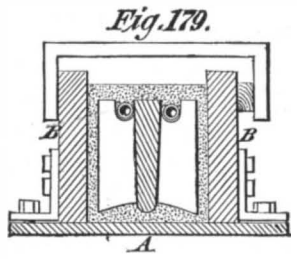


Fig. 179 is an end view of the core box, with core, shown in Fig. 175, but with the addition of the wooden binder, which serves to assist the brackets in holding the sides. B, of the core box together, which is necessary when the core box is very deep.

Communications.

Our Washington Correspondence.

To the Editor of the Scientific American:

The House bill relating to infringements, referred to in a previous letter, have been postponed to next December; in consequence of so much opposition being made to it, the Committee on Patents have been authorized to sit during the recess to revise and amend the patent laws. This bill will probably receive further consideration, when it is to be hoped that the obnoxious features will be eliminated or the bill dropped altogether. I understand that, among other amendments, the committee will be requested to consider the following: Separation of the Patent Office from the control of the Interior Department. The Commissioner and other officials, down to and including the examining corps, to hold their positions for life, or during good behavior. All the receipts of the office, under proper safeguards, to be used for facilitating its business. All agents, before being admitted to practice in the Office, to pass an examination as to competency. Everything relating to transfers of patents, including licences, to be recorded within sixty days. That owners of reissued patents shall be able to sue for infringements that occurred before the reissues were granted for such points as were covered by the original patents; and that applications and oaths for reissue applications may be made by the assignees of entire interests. These amendments to the present law I believe on the whole to be good sound doctrine, and such as will commend themselves to the majority of the people, whether inventors or not.

There is another point that should be considered, and that is the question: What to do with the models, where to put the vast accumulation (some twenty thousand per year), that are constantly arriving and have to be disposed of some how? There is yet room for a gallery on one side of the south hall, if Congress would but allow the Patent Office to use some of its own funds to build it; but, even if built, there would not be more than sufficient room to properly dispose of the models now lying around loose on the floors, stacked on the tops of the cases, and piled up one upon another on the shelves of the model cabinets until the under ones become broken from the superincumbent weight, and from the handling they receive in taking them in and out of the cases to make examinations. So many models have been destroyed by this method of storing in times past that there are cartloads of broken pieces stowed away in out-of-the-way corners.

If a little "more light" could be let in through the ceilings of the north and west halls, there is room for an additional gallery in each of them; but even these, if built, would soon be filled at the present rate of increase. In view of this, why not in future dispense with the models in such cases as do not actually require one to illustrate the invention? As the law now stands, the Commissioner can dispense with the model if he chooses, and for a year or so there were many patents issued without models being required; but for four or five years past, models have been required in all cases in which a model could be used. In the majority of applications models are not necessary to show the invention, and the only use for them in such cases is that they may be placed in the model room in order that inventors and others may see them when making preliminary examinations. As a printed copy of the drawing, suitably mounted on stiff cardboard and placed in the model cases or in adjacent portfolios, would answer quite as well, and not take up one hundredth part of the room, the model in nine cases out of ten might as well be dispensed with as not, and the inventor saved the expense of furnishing and the Office the expense of finding room and taking care of it.

Another point that should be considered by the Patent Commissioner is the necessity of having a complete system of digests published, after the style of the English abridgements. Some of the examiners have prepared partial digests of various subdivisions of their classes for their own use, but these are not accessible to most people; and some three or four such digests have been published, but at such high prices that the majority of inventors cannot purchase them, and they are therefore comparatively useless as compared with the great good that such publication would do if they could be issued at about the cost of printing, to say nothing of the advantage such digests would be to the examiners themselves in making their researches.

In my last, I stated that a bill had been passed appropriating money to build a national museum. I have since found, however, that my information was incorrect, and that it had only passed one House. It therefore failed to become a law, and the immense collection of Centennial exhibits will have to be stored for a year or so longer, and many of the articles be irretrievably ruined, and some of them may be withdrawn altogether. The collection is a very large one, and should be properly displayed and taken care of. The following is a list of the more important donations:

Argentine Republic: Almost the whole of the exhibit in Agricultural Hall, and the most of that in the Main Building, comprising ores, metals, pottery, tiles, stuffed animals, woods, fibers, leather, agricultural and fishery products.

Brazil Specimens of iron, coal, hides, leather, tiles, pottery, woods, vegetable fibers, food substances, gums, resins, etc.

Chili: A collection of minerals, artificial stones, tiles, terra cotta, and an extensive variety of grains, seeds, and other vegetable products.

China: The entire collection made by the Commissioner of Customs, including a complete representation of the manners and customs of the Chinese, having numerous full-sized figures beautifully executed and suitably dressed. Many hundreds of clay figures about one foot high representing the different classes and races of the empire, with specimens of their food, medicines, domestic utensils, musical instruments, samples of their manufactures, buildings, etc.

Egypt: Collection of minerals, tiles, pottery, garden products, woods, and a large collection of objects illustrating the manners and customs of the natives of Soudan, Nubia, and Abyssinia.

France: Messrs. Havilland, of Limoges, presented a pair of Centennial memorial vases valued at $17,000.

Germany: Tiles, cements, asphalt work, and manufactures in metals. Krupp, the great iron manufacturer, presented an extensive display, illustrating the mineralogy and metallurgy of Germany, with samples of his different manufactures.

Japan: Pottery and tiles, and a large exhibit of fishery products and apparatus, skins and hides of animals, food preparations, and a series illustrating the manufacture of tea, silk, and bamboo articles.

Mexico: Minerals, ores of gold and silver, obsidian, woods, fibers, pottery, and terra cotta, an iron meteorite weighing 4,000 lbs., etc.

Norway: A large collection of ores and other specimens exhibiting the metallurgy of iron, copper, nickel, etc., and a collection of the eatable fishes of Northern Europe, food preparations, etc.

Portugal: A very extensive exhibit of ores, minerals, etc., samples of industrial and vegetable products.

Russia: An enormous collection exhibiting the metallurgy of copper and iron, a very valuable collection of the minerals of Siberia, samples pottery, tiles, cements, etc.

Spain: A large collection illustrating the mines and mining of the kingdom, also its manufacturing and agricultural products.

Sweden: The entire exhibit of this country in the Agricultural Hall and photographs of arctic scenery.

Turkey: Illustrations of its metal work, mines, minerals, tiles, pottery, domestic and household utensils, etc.

Great Britain: A very large collection of the private exhibits of tiles, terra cotta, pottery, mosaic work, from Minton & Hollins, Doulton, and others. Among these are some very large vases, a terra cotta pulpit, and a group showing an allegorical representation of America, embracing several colossal figures, valued at $15,000. A complete collection, embracing over 300 varieties of wool from all parts of the world.

In addition to these, smaller collections from nearly all the other countries in the world that had exhibits in the Centennial have been received, making a most complete series of illustrations by which the manners, customs, manufactures, minerals, etc., of the different peoples of the world can be studied, the whole of which it is estimated to be worth over a million of dollars, and comprising a considerable section of the Centennial Exposition which may be examined by ourselves, our children, or children's children at leisure and without cost.

Congress, before adjourning, passed several acts authorizing the extensions of patents, but I have been unable to get a list of them yet, although I have made many attempts to obtain them. There is no accessible list of the bills that are passed, and no way of finding out until all the bills are printed.

The new Secretary of the Interior is fairly—or unfairly—besieged by applicants for office, but, as far as I can find out, with very poor success, and it is believed that very few changes will be made in the Patent Office. The present Commissioner, it is generally considered, is "the right man in the right place," and is likely to stay unless the President ignores the civil service reform altogether in his case.

The patent attorneys of this city have organized an association under the general incorporation act, known as the "Patent Office Bar Association of the District of Columbia." The objects of the association, as set forth in its constitution, are "to maintain the honor and dignity of our profession and increase its usefulness, promote the proper administration of the patent laws, and the protection of the rights and interests of inventors and patentees, and to secure a proper standard of character and qualification, and a prompt responsibility to public judgment among the practitioners before the Patent Office." Qualification for membership consists in being of lawful age and good moral character, and qualified by education, training, and experience to pursue properly the business of patent solicitors or attorneys. One of the objects of this association is believed to be the preventing from practising of the large number of irresponsible shysters who abound in Washington, who know nothing of patent law or practice, but who have the effrontery to advertise themselves as patent attorneys, and by offering to "put cases through" for very low fees, or on the "no patent, no pay" system, defraud their trusting clients and bring disgrace on a respectable body of gentlemen who have to suffer the obloquy of the wrong-doings of these miscreants. Several of these fellows have been debarred from practising for defrauding their clients, and it is probable the others will be shortly.

Washington, D. C. OCCASIONAL.

Lightning Rods—How the Centennial Buildings were Protected.

To the Editor of the Scientific American:

Your recent articles upon lightning rods supply much-needed information relative to the most important requisites for protection. The following system, as applied to the Centennial Machinery Hall, combines great economy with the most perfect protection and security, and may frequently be adopted with advantage for large buildings.

The tin roof of Machinery Hall has an area of 14½ acres, and this is utilized as a lightning conductor in this manner: Rising above the roof are 100 wood terminals (used as flag poles), to each of which is attached a copper wire rope ⅜ inch in diameter, its upper end rising a few inches above the top of the pole; at its lower end the wires are spread out, and 3 inches of its length is firmly soldered to the tin roof. Earth connections from this massive roof conductor are made at ten different places by soldering one end of copper ropes to the tin roof, the other end being firmly attached to 8 inch city water pipes in the ground. Thus it will be seen that every square foot of this huge building is covered and thoroughly protected by an ample conductor; and it is believed there is no building in this country so perfectly protected as this. The total cost was only one tenth the amount requisite to protect it in the usual way with rods, or less than $50 per acre.

Earth connections being all-important in all cases, I would recommend the following for country buildings: Extend the lightning rod underground, say 20 or more feet from the building; fasten and solder to its end a sheet of copper 2 by 4 feet; dig a pit 3 by 6 feet, and 4 to 6 feet deep; put 2 inches in depth of finely broken charcoal over the bottom, then put in the plate and rod, with another layer of charcoal and a few inches of earth; then fill up to surface with loose cobble stones, leaving it so that the rainfall can freely find its way down to the copper plate; water from the roof may be led into the pit. One such earth termination is of more value than half a dozen of the usual kind.

Philadelphia, Pa. J. D. RICE.

Heating with Natural Gas.

To the Editor of the Scientific American:

In your recent article on wholesale heating, you ask why some town does not immortalize itself by using natural gas as fuel. It is used extensively throughout the Pennsylvania oil regions; and this town is supplied by a well three miles distant, through a three inch pipe, which is being replaced by a five inch one, to be continued to adjacent towns. The gas is used direct from the well without a gasometer; and owing to the variation of pressure, it is somewhat dangerous in careless hands. For lighting it is but little inferior to coal gas. With a good fishtail burner, it burns without smoke, and with almost as brilliant a flame as the best artificial gas. The present pressure at the well is about 65 lbs. per square inch; and with a gasometer to equalize the pressure, it would be the best and safest fuel in use. M.

Millerstown, Pa.

An Electrical Balance.

At a recent meeting of the Institute of Mining Engineers, Dr. P. De P. Ricketts exhibited an electrical phenomenon with an analytical balance. By rubbing the glass case the balance was thrown out of adjustment, which could be restored by discharging the electricity of the glass. The possibility of errors in analysis resulting from this cause were apparent.

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A Sheffield Cutlery Manufactory.

Joseph Rodgers & Sons' cutlery works rank the first of the kind in the world, the factory having been established above a century and a half ago. The firm has a world-wide repute, and there is no doubt that the remotest country on the globe uses Rodgers' cutlery. The extensiveness of the manufacture and trade need scarcely be mentioned. Nothing, perhaps, in the shape of household articles—with the exception of crockery, which runs hand in hand with it—is so necessary and so much used as cutlery. The factory employs a large body of workmen, and the works are divided into a number of departments, such as the forging, the grinding, the polishing, the handlemaking, and various other departments. But the number of processes which the manufacture of each single knife has to go through before it is completed and ready for sale is something incredible. The first process is the forging. The workshops are generally small—for the forging of almost every kind of knife, with the exception of carving and larger knives, requires only one man. Many of these are connected with each other, and are all on the ground floor, the upper floors being occupied by more delicate processes. Each workshop contains a forge, one or two hammers, a pair of tongs, a long narrow table—on which the length of the blade to be forged is marked—a bucket or a small tub containing water, and several other necessary tools. With these the process of forging is executed with the greatest rapidity and precision. An experienced and skillful workman is able to forge 200 blades of ordinary penknives in one day, at the average of one blade in three minutes. The steel bars used for making blades are prepared in a separate department. They are made of different widths and thicknesses, according to the various kinds of knives to be manufactured. For penknives they are, of course, thin and narrow. The process is very simple. The steel bar (at first four feet long) is put into the fire, just a little longer from the end than the intended blade. When sufficiently soft it is taken out, and the red hot end cut to the exact length indicated on the table; and immediately after the bar of steel is again heated, in order that while the workman is forging one blade the material for another may be ready by the time he has finished it. Now, with the tongs holding the red hot piece in one hand, and the hammer in the other, the workman, standing at a short distance from the anvil, which is raised to a convenient height, executes his work with astonishing rapidity, for the entire blade is formed with a succession of only a few quick raps. Such is the skill of the workmen that the eyes of an ordinary visitor can scarcely detect any difference between any two of the newly forged blades. This done, the rough blade is once more buried in the fire, and a minute after it is drawn out and plunged into the bucket of cold water, by which process the blade is hardened.

The handle part (the stock of the blade and the pointed piece inserted into the handle) of a table or carving knife is made of iron. The joining is effected by heating the piece of iron cut off from a bar for the purpose and the handle end of the blade, and then welding them together; the proper shaping, with the indispensable pointed piece, has all to be done at once. Two men are required to carry through this process. It is very amusing to watch the dexterous movements of their hammers, which seem always to hit the right part mechanically, following, as it were, the rapid turning about of the material, well held in the grip of a pair of tongs under the management of one of the men.

From the forging workshops the blades are transferred to the grinding department, which comprises a number of processes; hence one knife generally goes through more than half a dozen hands before it is ready to be handled or cased. The grindstones are the same as those in ordinary use, and are worked by machinery. They are of different sizes, and vary extremely in quality—that is, from the coarsest stone for the first process to the smoothest used in the last. We were told that the quality of the steel of all knives (at least of the same forging) is exactly the same, and it is the process of grinding that the fate of the blade—its future quality and value—are determined. Hence, if 100 penknife blades were handed from a forging shop to the grinding department, 70 of them may perhaps go through the shilling processes, while the remaining 30 may go through superior processes, and afterwards be valued at half a crown or ten shillings each. Many perhaps would be puzzled at this mode of doing business, and would probably ask: "Why are not the whole hundred knives, etc., made the value of ten shillings, for the profit would then be greater?" The answer is simple. The half crown and ten shilling blades go through a greater number of processes than the shilling ones, and more care and attention are bestowed upon the work. Care and attention mean valuable time, and valuable time signifies great expense. However, the quality and value of a knife do not entirely depend upon the grinding; for as the price of a book is very often made lower or higher according to its binding so does the value of a piece of cutlery depend in some measure upon its handle or case. For instance, we were shown two razors of the same steel and forging, and were told that one was a shilling razor and the other half a crown. Now the cause of the great difference was simply this: the shilling razor had only a cow's horn handle, while that of the other was made of ivory, and, of course, its blade was better ground.

The processes subsequent to the grinding are stamping of the name with the words, "Cutlers to Her Majesty," and the corporate mark, the putting on of the handle, and the polishing. The corporate or trade mark (* +) of the firm of Joseph Rodgers & Sons consists of a star with six points and a Maltese cross. It was granted in 1764, and is valued at $300,000. Every piece of cutlery manufactured at these works bears the name and the well known mark.

The process of putting on handles to table and carving knives is very simple; but in the case of pen or pocket knives, where there are several blades, or any other kind of cutlery which is to be opened and shut, the work is a little more complicated, and therefore requires greater skill. In putting on the pins or rivets the workmen have to be very careful, in order that the blades may open and shut freely. The handles are made of elephants' tusks, pearl, and tortoise shell, and various kinds of wood, also stag and other horns. The former are imported from Africa and India, the African tusks being the finer and dearer. The tusks and horns are cut to the sizes of the required handles by machine saws, and afterwards they go through the more delicate processes of shaping, boring holes, etc. Lastly comes the polishing process. This is effected by applying the handles to revolving brushes, made, not of hair, but of linen stuff. The material is cut out in circular pieces of about 4 inches in diameter, with a round hole in the center; these pieces (a large number of them) are laid one on another in a cylindrical form, and the whole is then slipped on the spindle, the pieces being tightly held together by two small boards, one on each side of the spindle. These brushes are worked by machinery, and the effect of this mode of polishing is beautiful—smooth and bright; but the polish shows itself to the best advantage on dark handles, such as the ordinary shilling razor handles, which are generally made of cow's horn dyed or painted black, or variegated. This ingenious contrivance is an American invention, and is now largely used in works wherever polishing of this kind is necessary.

The men employed in this factory are paid according to their merit and capability, which plan can well be adopted with advantage in works of this kind, because it encourages them always to endeavor to do their best. It would be needless to mention the order and discipline we witnessed in Messrs. Rodgers' works, for any such attempt would be no addition to the long established fame of the firm; but it may simply be said that in this point of view no other works in England can be better conducted.

The show room, which we inspected on arriving and before leaving, was most attractive. The elegant and tasteful display of the various productions of the works—cutlery in all its forms—appeared magnificent. Penknives, table, and carving knives, scissors, razors, together with specimens of the electroplate works, are so arranged as always to be ready to attack the weak side of the liberal purchaser, especially of the fair sex. Two very curious pieces of cutlery adorn the show room. One of these is a kind of a huge "tool pocket-knife," consisting of 79 instruments—saw, corkscrew, gimlet, bradawl, file, etc.; the other has 1,876 blades to correspond with the Christian year, one blade being added to the number at the beginning of each year. These two, together with an enormous giantlike razor, are exhibited as curiosities of cutlery, and indeed they deserve that title, as they seem to be quite works of art.—*English Mechanic.*

A Novelty in Sonorous Tubes.

Our esteemed correspondent, Professor A. Ricco, sends us the following note from Modena, Italy:

"On blowing into a rubber tube having a spiral inside, such as is used for exhausting air, a note similar to that of a flute is heard, which becomes more and more acute the harder we blow. The successive harmonics up to the highest are thus obtained. By the use of a manometer, it is found that the necessary pressure of air is proportional to the square of the number expressing the order of the harmonic, or of the number of vibrations; which proves that the sound depends upon the velocity of the pulses of air striking against the turns of the helix. The notes are better when the tube is wound about itself. The diameter should not be large, and the length may be from 3 feet 3 inches to 26 feet. The long tubes give the most notes. Catching hold of one end of a tube and whirling it about like a sling, the centrifugal force produces a current of air and causes it to sound. A. RICCO, Professor.

"Modena, Italy."

Translator's note: The rubber tube referred to is one in which a wire helix has been inserted to prevent it from kinking or flattening out. This helix acts as a reed. Not having such a tube at hand, I succeeded in producing a number of distinct notes with an ordinary rubber tube; and my friend, Mr. Geyer, who is a better musician, inserted the *embouchure* of a French horn in a rubber tube a little over 5 feet long, $\frac{1}{16}$ inch thick, and having $\frac{1}{4}$ inch aperture. He then obtained a series of clear notes, which may be expressed by the following notation. Calling the lowest note produced the first harmonic (C), and the fundamental (C), we have

	C.....C.	c.	c.	*e.*	*g.*.....*c.*
Rate of vibration,	1.....2	3	4	5	6.....8

C. F. K.

Digging Wells Deeper.

In some districts there is probably no remedy for dry or empty wells, especially where water is found just upon or above granite or rock foundation. When the usual supply is exhausted, there is no other recourse but to wait for the influx of water from heavy falls of rain. Such cases, however, are exceptional, and in most localities the simple remedy for lack or scarcity of water is to deepen the wells. By digging down to water in a time of drouth, a never-failing supply is usually secured—in fact, it is almost impracticable to obtain it at any other time, as an excess of it prevents going to a sufficient depth. The easiest method with which we are acquainted for reaching water in a well already dug, but dry, says the *Portland Press*, is to sink a barrel or hogshead its entire length at the bottom of the well. This barrel or hogshead should be made of ash or oak, well hooped and without heads, and of such diameter as to allow of its easy descent inside of the bricks or stones of which the well is made. The earth and water can be removed in the ordinary way, and as the amount will not be large, without the use of the more expensive methods required in digging a well from the beginning. The bottom of a well will not be found to be the coldest and most uncomfortable place in the world at this season of the year, and we presume the entire job can be done with less risk and suffering than is incurred in some morning tramp to a distant stream with a drove of farm stock. While we recommend and prefer this way on account of its economy and simplicity, and because it secures a present and future supply of water, we also advise as a temporary expedient the substitution of the iron pipes used in the drive well system. These may be very readily driven down in a dry well to the necessary depth and connected with a pump, and subsequently upon the return of high water as easily removed. We trust that none of our readers will be guilty of abusing themselves or their animals by unnecessary exposure to the cold in search of water. If practicable, they should without delay test the plans suggested, or any others that their ingenuity may devise.

The Science of Preaching.

The Rev. Dr. Swing, editor of the *Alliance*, of Chicago, says: "If a clergyman feels that something should be said to telegraphers, he should not try to find a pole and lightning in the sacred word, but should honestly confess that the Bible does not specify any of the day or night operators, and that hence he will not take a text, but will speak to men in the spirit of Christ, and not from a figure by Job or Ezekiel. This bondage to a text was well ridiculed by the story of the man who preached against lofty headdresses from the words: 'Top not come down.'

"Inasmuch as the world has become larger and fuller since the Scriptures were compiled, the clergy should not expect to find in those records any special advice to railroad men or steamboat captains, and hence would do religion more service by omitting a text than by citing Jehu as a prophecy of fast travel, or by alluding to Noah as a great captain on the high seas. Textual preaching is a good thing when there is an idea in the text to be developed; but when a preacher has a valuable lesson for a book agent or a sewing machine man, he need not soil his concordance to find what mention the Bible has made of these two forms of itineracy. Of course, he might find a remote allusion to them in the prophecy that in the latter days of the world great tribulations should come; but so many in the audience would doubt this application of the passage that it would seem better to preach to the souls of the agents and let the text go by the board. What a preacher needs most is not a doubtful text, but a real subject."

Watering Ships in Mid-Ocean.

M. Toselli, that exceedingly prolific inventor of diving machines and wreck-raising apparatus, proposes the very original idea of utilizing the springs of fresh water which are known to find their outlets on the bottom of seas, in order that vessels may always obtain a constant supply of pure water even when in mid-ocean. His mode of putting the notion into practice sounds easy enough; but we doubt whether it will prove so simple when it comes to be tried. The first thing to do is to find the springs; and that, we should imagine, would resemble a search for extremely small needles in a colossal haystack. But M. Toselli thinks that they can be found—the springs, not the needles—and he says it only remains to secure tubes to the outlets, of sufficient length to reach the surface, buoy them of course, and there are inexhaustible wells always available. There are some minor difficulties of the tubes being carried away by storms or ocean currents; but these, as well as those pertaining to the discovery, the indefatigable inventor tells the French Academy of Sciences he has overcome. We hope he has.

Poisonous Fireworks.

A correspondent, referring to our article under the above heading stating that a lady in Bristol, N. H., died from the effects of fumes from red fire, doubts whether this was the cause of her death. But if the red fire used was such an absurd composition as nitrate of strontia, black sulphide of antimony, sulphur, and chlorate of potash, it is evident that the arising gases must be injurious to health. Many recipes current in newspapers, scientific books, and even school books, are bad, and are evidently copied from some old, obsolete publication. "Properly made red fire," says our correspondent, "should contain no sulphur or antimony in any form whatever."

A PATENT has been taken out in France by M. Béranger for the cleansing of wool, woolen goods, woolen rags, etc., by means of sulphate of ammonia with heat; the stuffs to be treated are submitted for twenty minutes to the action of sulphate of ammonia and water marking 5° or 6°, then dried by means of the centrifugal machine and the stove. It is said that the color of the goods, however dyed, is never affected by this treatment.

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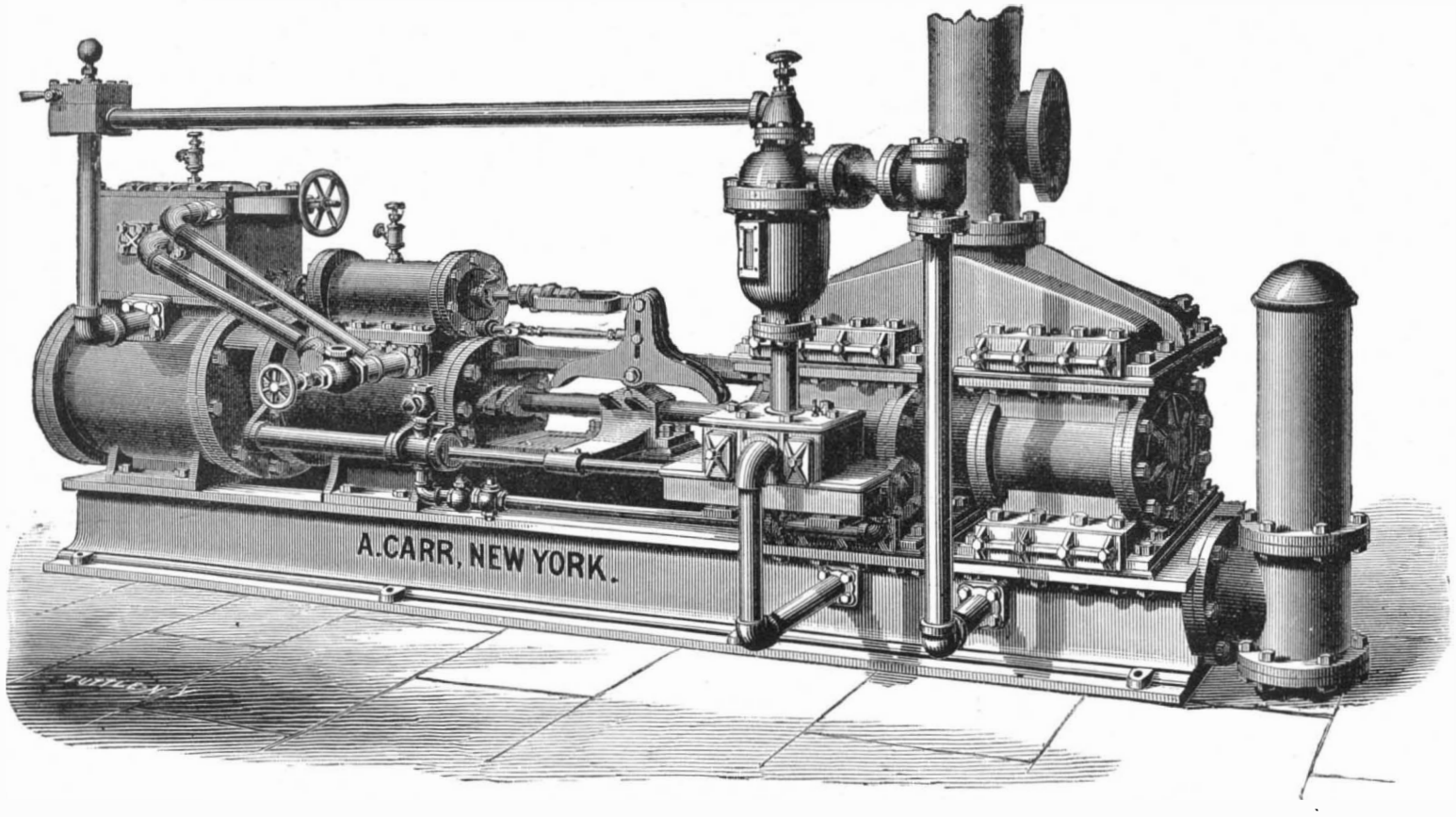
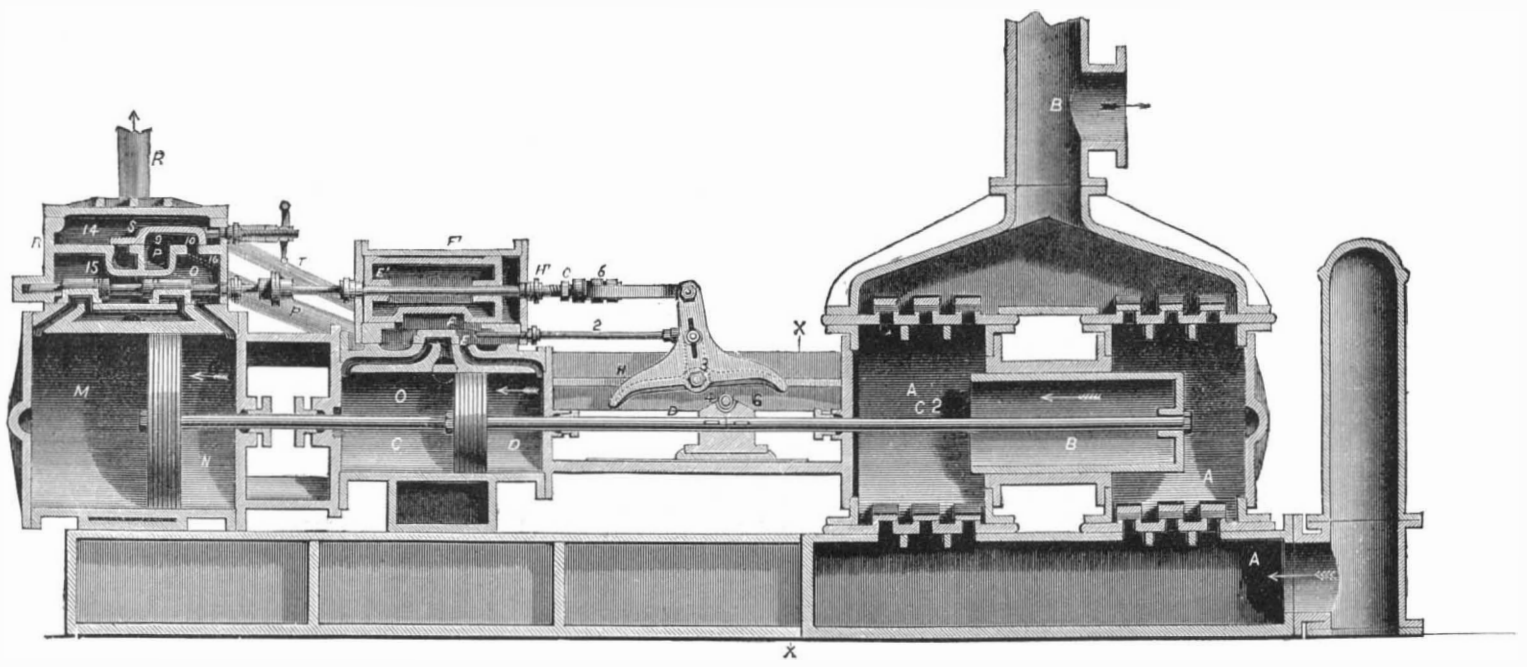
THE SELDEN COMPOUND PUMP.

A high degree of expansion combined with a regular and steady velocity of piston has, we are informed, been obtained by Mr. A. Carr, of this city, by the compounding of his Selden pump. This pump, in its original form, consists of a steam and water cylinder, set in a direct line and connected rigidly by a center piece, the rod passing directly from the steam piston to the water piston, and being rigidly fastened to both. We give in the annexed engravings a perspective view of Fig. 1, and a sectional view of Fig. 2, showing the machine as compounded.

The larger or secondary cylinder, M, of the compound engine is provided with a piston, N, the rod of which passes to the piston, D, of the high-pressure cylinder, so that the two pistons move together, one in aid of the other, and both exerting their power upon the piston rods. This feature of a compound engine is not new, save in its combination with a direct acting pump, by connecting the valve, O, of the secondary cylinder with the valve-moving piston, E, of the primary engine, so that the steam acting upon this piston moves the valves of both engines simultaneously to open and close the respective ports. Ordinarily the exhaust steam from the primary engine passes by the pipe, P, to the valve chest of the secondary engine, and the exhaust steam from the secondary cylinder passes by the pipe, R, to the condenser.



THE IMPROVED SELDEN PUMP.—Fig. 1.



THE IMPROVED SELDEN PUMP.—Fig. 2.

In order to arrange this engine so that the secondary engine may be partially or entirely supplied by live steam from the boiler, as occasion may require, the exhaust steam is led through the ports 9 and 10 in the divided steam chest, R′, and through the D slide valve, S, that is placed over these ports, and said valve is operated by a handle, 12, or other means. The face, 14, of this valve, S, is wide enough to cover the secondary exhaust port, 15, when the face, 16, of the valve is over the port, 10. This face is narrow, so that the exhaust steam can pass through the port, 10, at one side of such face, 16, and the live steam will pass by the pipe, T′, in at the other side.

The relative widths of these openings can be varied by moving the valve, S; and by shifting the valve, the exhaust from the primary engine will pass from 9 through the port, 15, and pipe to the exhaust, R, and the steam from the boiler will go to the secondary cylinder by the port, 10, so that the secondary cylinder may be operated by the boiler steam or else by the exhaust steam from the primary cylinder, as occasion may require.

Dangerous Toys.

The past few weeks have been a harvest season for dealers in toys, candies, and all sorts of trifles, especially those intended for Christmas gifts to the dear children. Happy the family who have not suffered from the diabolical schemes of the rapacious manufacturers. We do not refer to the little victims who paid the usual penalty for consuming candy and nuts in intemperate quantities. Unfortunately there are manufacturers who delight in introducing copper, lead, arsenic, and other deadly poisons into the nursery and kindergarten. So much has already been said and written in regard to Paris green that most intelligent and reading parents avoid presenting their little ones with green-colored picture books, or toys painted that color. We are sorry to say that other colors are frequently poisonous, and it is hardly safe to place any painted toy in the hands of a child that is liable to suck it or kiss it, as the little ones often do.

There is another class of articles, which have always been regarded as particularly safe and unobjectionable, but which have proven quite as dangerous as many other toys, namely, those made of india rubber. In a recent number of the *Deutsche Industrie Zeitung*, in regard to the use of oxide of zinc in india rubber, it is stated that the use of such rubber tubes and stoppers for nursing bottles was proven so injurious to health that the agitation against it abroad has had the effect of driving it from the market. B. Tollens, of Göttingen, has, however, found that most of the toys, dolls, animals, etc., are still made of rubber with oxide of zinc in it. A case where a child was taken sick after playing with an india rubber doll, and putting it in the mouth frequently, and where the doll, on being thrown into vinegar, became covered with an incrustation, probably acetate of zinc, first directed Tollen's attention to this subject. He made an analysis of the doll and found that it contained not less than 60·58 per cent of oxide of zinc. Some lime, oxide of iron, and phosphoric acid were detected in the ash. Another doll, purchased in Brunswick, and especially recommended as "harmless," gave 57·68 per cent of ash, which consisted of oxide of zinc with traces of impurities—lead, iron, lime, and sand.

Ant Intelligence.

Sir John Lubbock has recently delivered a lecture on ants, which is replete with curious and interesting information, the result of his own examination of some thirty nests of over twenty formic species, which he keeps under constant supervision. Sir John has not acquired a very high idea of the much-vaunted intelligence of the ant. He says that, when he cut off their food supply by drawing back a little strip of paper which had acted as a bridge, they had not intelligence to rebridge the chasm of one third of an inch by pushing the strip of paper back. Varied experiments of a similar character resulted in the same way, except where a hole leading into a box containing food was stopped by a little mould; then the ants speedily burrowed into the mould, and found their way into the box and again carried off the food. Sir John did not find that display of intelligence and affection which some naturalists have declared induce ants, when any of their companions are accidentally buried, to burrow down and rescue them. They do seem capable of discriminating between companions and strangers; for when a number of each were intoxicated and placed near a nest, the sober ants, after being very much puzzled at the unaccountable condition of the inebriates, carried into the nest their helpless friends and pitched the strangers into a dish of water. When, however, some friends and strangers were chloroformed to death and laid near a nest, the ants seemed to appreciate that the deceased were past remedy, and therefore pitched both friends and strangers indiscriminately over the edge of the table. Attempting to verify the

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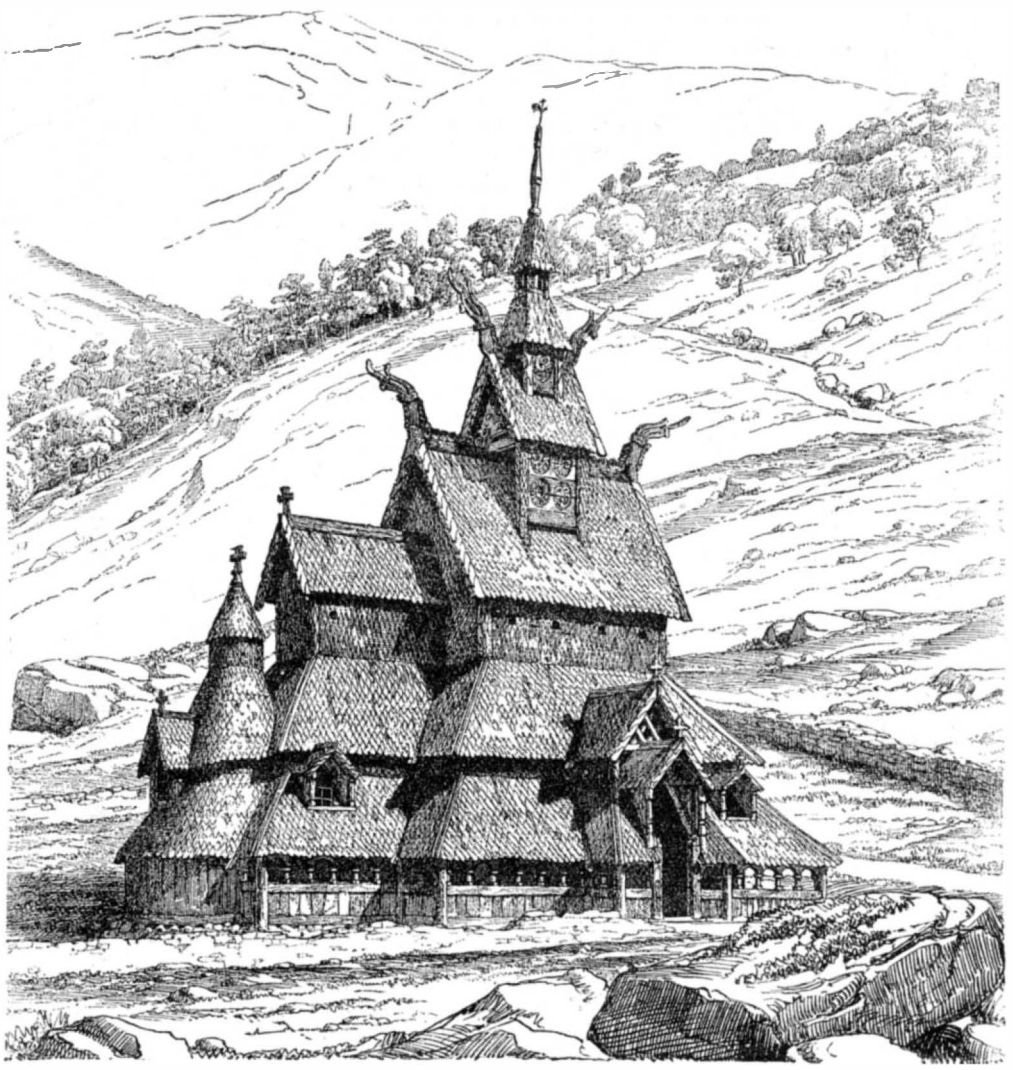
truth of Huber's declaration that, when ants had been separated for four months and then returned to their nest, they were recognized and caressed by their companions, Sir John found that, though there was no sign of recognition when a separated friend was returned to the nest, he was never attacked, while a stranger being put in was always driven out or even killed. As regards the senses of ants, though Sir John believes they hear, yet they take no notice of any sound he could make; and though they undoubtedly see, they cannot have very keen sight. His experiments do not confirm the suggestion that ants are able to communicate to their companions where food has been discovered; for when single ants had been placed on food, and, going back with some to the nest, were returning with companions to the store, in every case where these pioneer ants were captured their companions wandered about helpless and failed to find their way to the spot.

A NORWEGIAN TIMBER CHURCH.

There exists in Norway, says the *Building News*, a series of wooden churches of great interest to the antiquary. The subject of our engraving is, perhaps, the most curious of them all. Situated in the neighborhood of some of the wildest and most romantic scenery in the country, it is of strange and fantastic design, and the carved pinnacles at its angles give it the appearance of a Chinese pagoda rather than a Christian church. The building is entirely of pine, the roof and walls being covered with tooth-shaped shingles, protected from the weather by layers of pitch. It possesses nave, chancel, and apse, the roof of the latter forming a most curious feature—resembling a large beehive. A covered way, about 3 feet wide, runs all round the church. It is believed to have been erected in the 11th or 12th century, and the resemblance which the mouldings and capitals bear to English architecture of that date fully bears this out.



ANCIENT TIMBER CHURCH IN NORWAY.

The Lesson of a Life.

In December, 1845, in the Department of the Vosges, Xavier Thiriat, a boy of ten, accompanied four young girls of about the same age to the church. They had to cross a brook, over which was placed a single loose plank. The boy crossed safely, the first girl who attempted it fell in. The boy jumped in, pulled her out, and then, walking in the water, guided each of the girls across. Some time was lost by this, and the party reached the church late. Xavier, ashamed of being late, did not go up to the stove, but kept behind. He reached home chilled, a dangerous disease followed, by which he was left a complete cripple for life; his only mode of moving about was on hands and knees, so completely were his legs paralyzed and distorted. Coming of very poor people, there was every prospect that Thiriat would be a heavy charge to his family and a wretched burden to himself. Instead of this, he reached manhood bright, cheerful, and intelligent. Reading all the books which he could lay hold of, he was soon the best educated man in his district, and rapidly acquired extensive influence, which was always used for good. He induced the young people to read and to study. Some contributions to the local newspaper, the *Echo des Vosges*, attracted attention and made him known, the result of which was that further intellectual opportunities were extended to him. He made himself a good botanist, meteorologist, and geologist, instructed others in these branches, and procured the foundation of several local libraries. He could not, however, be satisfied without achieving his complete independence and earning his support. He obtained the position of manager of the telegraph at a neighboring town, was made secretary to the mayor, became a favorite correspondent of several agricultural papers, and received the highest reward of the French Franklin Society—its gold medal.

All this was accomplished by native force of character and strong religious feeling, under circumstances not merely adverse, but at first absolutely hopeless. A horrible deformity, intense suffering, absence of instruction, crushing poverty—all these disabilities were overcome unaided, and this ignorant and crippled lad made himself the light, intellectual and moral, of his whole district.—*Public Ledger.*

Sumac.

Sumac (called by botanists *rhus coriana*), owing to the large quantity of tannic acid which it contains, is extensively employed in dyeing, tanning, in the manufacture of writing inks, etc. Thousands of tons of the dried and powdered leaves and stems of this shrub are annually consumed in the arts. It comes into market in the form of a fine yellowish powder, its chief source being the island of Sicily, where it is extensively cultivated. Its present market value in New York is: Fine Sicilian powder, $120 per ton; Virginia, $65 per ton. The poorer qualities sell for from $50 to $60 per ton. Various attempts have been made to reduce the great expense attending the transportation of the crude sumac for market by extracting the tannin directly upon the ground where the material is harvested, and sending the extract into market in a concentrated form; but it has been found that such extract cannot be kept for any length of time, as it is liable to a species of fermentation which converts the major part of the tannin into gallic acid, and greatly impairs its marketable value.

Diamond Cutting by Girls.

This is another new trade for women, and we wonder that those who are seeking new outlets for feminine work have not thought of it long ago. Diamond cutting is the mechanical labor which above all others requires that extreme delicacy of touch and nice perception of form, color, etc., which is inborn in the majority of women, but which nearly all men are compelled to use much practice to acquire. Diamond cutting involves no severe physical labor, except possibly in the grinding of the stones together to form the facets. That branch, requiring powerful wrist muscles, may be left to the men; but every other process, from the splitting of the rough gems up to the final polishing, is fully within feminine capabilities.

Twenty-three young women are now successfully working at this trade in Roxbury, Mass. and the credit of teaching them is due to Mr. Henry D. Morse. That gentleman has hitherto employed trained diamond cutters from Amsterdam; and by carefully watching them he became quite an expert himself. The Amsterdam cutters are nearly all Israelites, and they are exceedingly chary of imparting their knowledge to strangers, preferring to teach only their sons or family relatives, or at best Dutch boys of their own selection. It is their invariable rule to decline to take apprentices except under the above restrictions; and accordingly, when Mr. Morse requested his workmen to teach American boys, they peremptorily refused. Anticipating this result, he had secretly established a shop in Roxbury, and there had taught six or eight girls. Consequently, when his men mutinied, he discharged them forthwith, and replaced them by his female employees. The Yankee girls are now cutting and polishing diamonds in superior style.

The Dairy Interests of the United States.

The fourth annual convention of the National Butter and Egg Association was recently held at Chicago, Ill., and was very largely attended. The President, Mr. George E. Gooch, of Chicago, spoke of the benefit which the trade derived from such meetings, and of the magnitude of the interest, adding that $6,000,000 worth of butter was sent eastward from Chicago during the past year. The butter and cheese produced in this country last year reached a value of $124,000,000, and the milk sold in addition was 325,000,000 gallons. He also called attention to the prizes, value $1,500 gold, to be given for the best exhibits of butter and cheese by the Royal Agricultural Society of England, at their meeting to be held in Liverpool next July, the competition being open to all the world. The shipment of butter in vessels provided with refrigerator rooms, such as are already used for conveying beef to Europe, was suggested; and the growing trade in spurious butter under various pretentious names was discussed and condemned. Many of the members present urged that legislation should put a stop to the sale of these compounds as butter. Legislation cannot stop the manufacture of any article not proved to be pernicious to the public; but it might properly compel the seller to designate, on his package, of what the contents consist, so that the purchaser may not be deceived.

The Manufacture of Ammonia Salts from the Ammoniacal Gas Liquor.

The following method of preparing ammonia salts from the gas house waters, by means of soda salts, is particularly interesting, since it produces a pure carbonate of soda at the same time, and is both cheaper and easier than the Solvay soda process; and it involves no waste products. Dr. G. T. Gerlach, of Kalk, near Deutz, is the inventor of the process.

If sal ammoniac is the salt we wish to obtain, chloride of sodium (table salt) is of course the source of the chlorine, and the process resembles in some respects that of Solvay. The crude ammoniacal liquors are first distilled and yield carbonate of ammonia: in this is dissolved a quantity of common salt, equivalent to that of the carbonate of ammonia present. This solution has a gravity of 1·22. Into it is passed a current of carbonic acid gas, as long as any bicarbonate of soda is precipitated. Some sulphuretted hydrogen is thus expelled, which had passed over in the form of sulphide of ammonia. The precipitated bicarbonate of soda is removed and dried; and on heating, enough carbonic acid is expelled to serve for the next operation, monocarbonate of soda remaining. The liquid contains chloride of ammonia with some undecomposed carbonate of ammonia, with chloride of sodium and a little dissolved bicarbonate of soda. The carbonate of ammonia is recovered by distillation, the sal ammoniac and salt by crystallization after concentration. Instead of being decomposed by lime, as in Solvay's process, the sal ammoniac is sent to the market. If, however, it is desired to make *aqua ammoniæ*, some of this mother liquor is treated with lime and distilled.

If sulphate of ammonia is the product desired, the sulphate of soda is employed to decompose the carbonate of ammonia. Either crystallized Glauber salt is dissolved in the concentrated solution of carbonate of ammonia, or the anhydrous sulphate (salt cake), obtained in the manufacture of nitric or hydrochloric acid, is dissolved in a less concentrated solution of the ammonia salt. Equivalent proportions of the salts are employed, and the solution has a specific gravity of 1·3. Carbonic acid is passed into this solution until the bicarbonate of soda ceases to be precipitated. The latter salt is removed and dried as before. In solution are sulphate of ammonia, undecomposed carbonate of ammonia and sulphate of soda, with a trace of dissolved bicarbonate of soda. The carbonate of ammonia is recovered by distillation, the other salts by concentration and crystallization.

When nitrate of ammonia is the product required, the carbonate of ammonia is decomposed by means of Chili saltpetre, or nitrate of soda. The reactions are the same as before, the chief products being nitrate of ammonia and bicarbonate of soda.

It is evident that the use of chloride, sulphate, and nitrate of soda, instead of the corresponding acids, must be both cheaper and more convenient, while the simultaneous production of soda ash still further increases the profits. The separation of the salts which remain in solution is an easy matter, owing to their unequal solubility. In the first case we had common salt and sal ammoniac; on concentrating to a certain point the former will crystallize out of the boiling solution, and after this is removed the solution is allowed to cool, when the latter will crystallize out. Sulphates of ammonia and soda crystallize from solution as a double salt containing two equivalents of water of crystallization. But on evaporating a solution of these salts to a certain point, the anhydrous Glauber salt will separate, and sulphate of ammonia will remain in solution. The anhydrous Glauber salt is not pure, and is employed for decomposing a fresh quantity of carbonate of ammonia. In separating table salt and Glauber salts at a boiling heat, care must be taken not to burn the salts, and on a large scale steam heat should be employed.

A GOOD waterproof cement may be made by mixing glue 5, rosin 4, red ocher 2 parts, with a little water.

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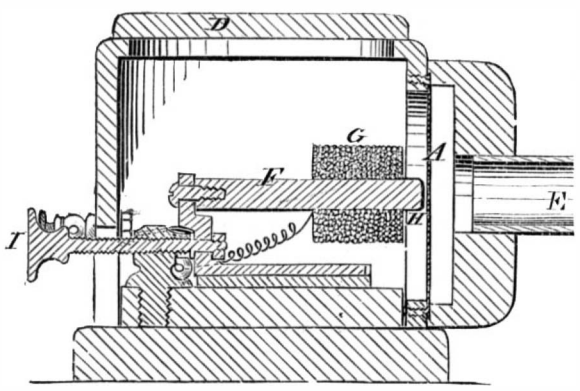
[*Continued from first page.*]

sounds of different degrees of the gamut be made simultaneously before No. 1. These also will be repeated by the other instruments, and the same would be true if, before the first instrument, any number of different sounds were made. Now, let it be previously understood that all messages sent to station No. 2 will be uttered in note C for instance, those to No. 3 in note D, and so on, a different note for each station; then, as the signals for each message differ in pitch from those for all the other messages, the operator has only to fix his attention upon the message sounded in the note he has learned to recognize, and he may ignore all the rest. In this way, the number of despatches which may be sent simultaneously is very large. Where, however, a large number is forwarded, rendering it the more difficult for a receiving operator to recognize his particular note, his message may be automatically received by a resonator provided with a membrane which vibrates only when the note with which the resonator is in unison is emitted by the receiving telephone. The vibrations of the membrane may be made to operate a circuit breaker, which will operate a Morse sounder or a telegraphic recording apparatus. Of course where several persons speak in the vicinity of telephone No. 1, their utterances are in a like manner simultaneously transmitted to all the telephones in the circuit. If this verbal

Fig. 4.



communication should be used for telegraphic purposes, the messages would have to be taken down by the receivers in short hand. We understand that Professor Bell has patents pending for some further improvements in his apparatus. These we shall notice at some future time.

We are indebted to a correspondent for the sketches whence we have prepared the engravings (Fig. 1, front page) representing Professor Bell lecturing on the telephone, at Salem, Mass., on February 12 last, and also the group in the inventor's study, in Exeter place, Boston, receiving his communications during the course of the lecture. The apparatus, an exterior view of which is also given, is all contained in an oblong box about 7 inches high and wide, and 12 inches long. This is all there is visible of the instrument, which during the lecture is placed on a desk at the front of the stage, with its mouthpiece toward the audience. Not only was the conversation and singing of the people at the Boston end distinctly audible in the Salem hall, 14 miles away, but Professor Bell's lecture was plainly heard and applause sent over the wires by the listeners in Boston.

Professor Bell was born in Edinburgh, Scotland, and came to this country about six years ago. His father, Professor A. M. Bell, who became noted as the inventor of a method for teaching deaf mutes to speak, and of a universal system of phonography, is now living in Brantford, Ontario. Professor Graham Bell, the present inventor, has also been exceptionally successful in the instruction of deaf mutes, and in one case he has enabled a girl who had never produced an articulate sound to pronounce words distinctly after having her under his tuition for the short space of two months. "If I can make a deaf mute talk," the now famous inventor is reported to have said, "I can make iron talk." We need not add that his promise has been fulfilled.

Electro-Chemical Illumination.

MM. Gauduin and Gramme have recently conducted a series of experiments in order to determine the effects of various foreign substances, combined with carbon pencils, upon the production of electric light. The materials introduced into the pencils were phosphate of lime (from bones), chloride of calcium, borate of lime, silicate of lime, pure precipitated silex, magnesia, borate of magnesia, phosphate of magnesia, aluminum, and silicate of aluminum. The proportions were calculated so as to obtain 5 per cent of oxide after the baking of the pencils. The latter were submitted to the action of a current, always in the same direction, furnished by a Gramme electric machine of sufficient power to form an electric arch of from 0·4 to 0·6 inch in length. The negative pencil being placed below, the following results were observed:

1. The complete decomposition of phosphide of lime. Under the triple influence of electrolytic action, calorific action, and the reducing action of the carbon, the reduced calcium accumulated on the negative pencil, and burned (in contact with the air) with a reddish flame. The lime and phosphoric acid produced abundant smoke. The light obtained, measured by the photometer, was double that yielded by pencils of similar dimensions made from gas retort residue.

2. Chloride of calcium and borate and silicate of lime were also decomposed; but the boracic and silicic acids seemed to be volatilized through the action of the current. Less light was obtained in this case than with the phosphate of lime.

3. Silex rendered the pencils worse conductors, diminished the light, and melted and volatilized without becoming decomposed.

4. Magnesia and borate and phosphate of magnesia were decomposed. Magnesium in vapor went to the negative pencil, and burned, in contact with the air, with a white flame. Magnesia and boracic and phosphoric acids escaped in the state of smoke. The augmentation of the light was less than with the lime salts.

5. Aluminum and silicate of aluminum were decomposed only with a very strong current and large electric arch; but under these circumstances the decomposition was quite manifest, and the aluminum vapor could be seen leaving the negative pole, as from a gas jet, burning with a dull bluish flame.

The authors state that, considering that the flame and smoke which accompanied these electro-chemical lights would prove a great obstacle to their utilization, they continued their experiments no further. They point out, however, that the introduction of foreign bodies into pure carbon pencils is an excellent mode of studying the effect of electricity upon such bodies, which is susceptible of many very interesting applications.

Planing Mill Machinery.

An important point to be observed in the care of bearings for fast running journals is their lubrication. In needs no argument to demonstrate the necessity that exists for lubricating a shaft or bearing, and none to prove that the best and most economical way is to do it properly. Cylinder bearings that are supplied with oil from below, by means of wicks, valves or capillary attraction of any kind, should never be used, as they cannot be trusted for any length of time, and the result is that the operator pours on just as much oil—and wisely, too—as if they were of the ordinary pattern.

The common practice of squirting the oil from a can is another bad plan and very wasteful. Generally where one quart is really used in this manner five are wasted; and thus mill owners are often induced to buy cheap oil under the impression that it lasts just as long as the best, as it certainly does when an operator thinks he must use just so much and apply it just so often no matter what the quality may be.

For the journals of high speed machinery only the best lard or sperm oil should be used, and it should always be fed from an adjustable glass oiler placed on the top of the can in plain sight. "With this arrangement I have seen," says Mr. F. H. Morse, in the *Northwestern Lumberman*, "under my supervision, 24 inch machines with 8 inch journals run steadily for 10 hours, as a test, with only a teaspoonful of sperm oil to each journal, and at the end of that time the spindles were as cool as if they had run only half an hour. However incredible this may seem to those who are in the habit of applying more than that every 15 or 20 minutes, it is a fact, and one which I can readily substantiate. If those in charge of planing machinery would pay more attention to this part of their business and use more care and prudence than they usually do, the expense account of many mills might be sensibly reduced."

It should be the aim of every foreman and superintendent of a planing mill to keep the machines under his charge constantly at work, as no machine was ever known to make a dollar by standing idle. There may be cases where, had all the machines stood idle, or had they never been started, their owners would have been better off; but the fact still remains that, if there is any profit in running a planing mill at all (and certainly it should not be operated when there is not), it must be made by keeping all the machines steadily at work. If there are more machines in a mill than the amount of business calls for, part of them should be stopped altogether, and only those which are required for the various kinds of work, and which can be kept steadily employed, should be used. It does not pay to keep an operator standing idle over his machine one third of a day that he may work the balance of the time; for when he stops, his assistants and the machine stop, and consequently the profits stop; but his wages do not, neither does the interest upon the capital invested. There was a time, not many years since, when the profits of the planing-mill business were large enough to withstand such drawbacks; but that day has passed, and now it is only with the best management in every particular that it can be made to pay even a moderate percentage upon the investment.

A Gigantic Model Dairy.

The food supply of London has long engrossed a large share of public attention, and upon the purity of the articles supplied depends in a great measure the health and happiness of its inhabitants. Some ten years since the design was introduced of supplying the dwellers in this great city with milk and other dairy produce which, for general excellence, could not be surpassed. Like most good works, these laudable efforts were at first in a great measure abortive; but, by dint of perseverance and good management, the Aylesbury Dairy Company has assumed an importance far exceeding even the most sanguine expectations of its originators, and may fairly be designated one of the most useful and prosperous corporations now in operation. To give some idea of the gigantic nature of the business so successfully developed by this company, we may state that they daily supply some 5,000 families with milk, which is guaranteed, so far as human care and judgment can insure it, to be not only of the purest description, but obtained from perfectly healthy sources. Upwards of 25,000 gallons of milk are dealt with every week, being the produce of nearly 50 farms in some of the best of our dairy counties. To carry on this enormous trade the company have, in addition to their town premises in St. Peterburgh place, Bayswater, a large factory at Swindon and a dairy at Bourton, where all the surplus milk is converted into cheese. With such admirable sources of supply, it is not a matter of surprise that the business has rapidly extended, and that so successful a commercial result has been achieved. The Aylesbury Dairy Company can take into their Swindon factory 3,000 gallons of milk daily, which they hold, as it were, in reserve. In the summer time, when the fashionable world is seeking recreation in garden parties, and when strawberries and cream and other suchlike seasonable delicacies are in request, then the company are in a position to meet any sudden demand. They possess every modern appliance suitable for the dairy, and have the power of setting 1,500 gallons of milk in 800 square feet of milk pans—the product from which in 10 hours' time would be a large quantity of cream. The cream is daily sent to London; and, after the orders are executed, the surplus is made into butter, the excellence of which is such that the demand exceeds the supply.—*London Court Circular.*

Wash for Fruit Trees.

At the last meeting of the Farmers' Club, a stranger inquired how he might remove the scales from the bodies and branches of his fruit trees.

The chairman stated that W. S. Carpenter used to put a pound of crude potash in two gallons of water, and after the potash is dissolved, dip a large swab in it and apply the liquid to the trees, which will kill the embryo insect in the scales.

Mr. Whitman said: That is a good remedy where one can get potash. But as this article is so unpleasant to handle, so difficult to procure except by the barrel, and so costly by the pound, I prefer to use cheap soap, with which I make a strong liquid and apply it with a swab. I have tried tobacco, soap, and carbolic soap, which are very expensive. Now I procure the Washington soap, which can be obtained in almost every city and village by the box, at only a few cents per pound. I take a cake of this soap, shave it up into thin slices and dissolve it in a pail of hot water. After it has stood a day or two the liquid will appear like mucilage, which is applied to the bodies of the trees when it is almost boiling hot. One or two applications will remove all the scales and make the bark look smooth and healthful. I procure a box of this soap every year, not only for the trees, but there is no better soap for culinary and laundry purposes.

Carbonic Acid Exhaled by Animals.

A German chemist has made a long series of careful experiments to ascertain the quantity of carbonic acid given off in respiration and perspiration by different animals. From among his most important conclusions, printed in the *Journal of the Chemical Society*, we select a few which appear worth wider notice. In proportion to their weight, the largest quantity of carbonic acid is given off by birds—mammals come next—and worms, amphibia, fishes, and snails form another group in which the excretion of carbonic acid is much smaller; of these, worms give off the most, and snails the least. Those that live in water give off more carbonic acid to the air than they do to the water; and young animals more than old ones. Experiments with colored light show that under the green and yellow more carbonic acid is excreted than in ordinary daylight; and on comparing light and darkness, it was found that much less carbonic acid is given off during the night than during the day. In colored light the milk-white and blue rays come next to the green and yellow in activity; and the red and violet are the least active.

Produce Exported in One Day.

Some idea of the vast amount of produce going from this country may be formed from the following statement: Portion of shipment from the port of New York, Saturday, March 3, taken from official sources: Corn, 99,735 bushels; apples, 2,100 barrels; bacon, 2,566 boxes; cheese, 2,400 boxes; butter, 3,827 packages; fresh beef, 90 tons, 1,488 quarters; sheep, 385; miscellaneous: 3,500 pieces maple timber, 600 barrels of oysters, 500 packages of agricultural implements, 450 tierces of lard, 24,025 cases of canned goods, and 500 barrels of shoe pegs. A single manufacturer in this city turns out 1,200 bushels shoe pegs a day. His best foreign market, he informs us, is Germany.

Pigs and Poisonous Plants.

A correspondent writes to point out that, in our recen article entitled "Absence of White Color in Animals," Mr. Darwin is quoted as to the effect of a poisonous plant on pigs in Virginia, with the comment of Dr. Ogle that there is no proof that the black pigs eat the root which poisons the white pigs; but, in fact, the white pigs are deficient in taste and smell, and not able to discriminate as to poisonous plants, etc. Our correspondent does not know what plant has such effects on pigs in Virginia, but there is a plant in Florida which may be the one referred to by Mr. Darwin. It is called paint root, and the root is a small bulb. The root and top are used as a dye by the Indians. Hogs are very fond of it, and hogs with black hoofs fatten on it; but those with white hoofs become lame and the hoof drops off. If a hog has three black hoofs and one white, the white one will fall off.

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Postal Card Ink.

With the numerous useful and useless little inventions for which our country is noted, it is surprising that no one has yet placed in the market any kind of invisible ink for postal cards. Although we do not believe that such ink would prove very useful, it would probably meet with considerable sale, partially from the novelty of the thing. Many kinds of magic ink have been known for years, but most of them possess some disadvantages. A writer in the *Deutsche Industrie Zeitung*, in discussing the subject, claims that postal card ink should possess the following properties: 1. The writing must, of course, be invisible at first. 2. It must be of such a nature as to be rendered visible quickly and easily by means in the possession of every one at all times. 3. There should not be several kinds of this ink in market, one of which is developed by light, another by heat, a third by common salt solution, etc., so that, on receiving a blank card, the receiver would be at a loss to know how to develop it. This writer then goes on to recommend the use of a solution of nitrate or chloride of cobalt, mixed with a little sugar or gum to make it flow easily from the pen. Such writing is made visible by moderate heat, even a burning match being sufficient. Dr. Böttger, in a note to this article, recommends the use of ferrocyanide of potassium, or yellow prussiate of potash, which is readily developed by the sulphates of copper and iron (blue or green vitriol), the former yielding brown, the latter blue, letters.

Dr. Böttger is an exceedingly ingenious chemist, and most of his suggestions are very practical, but we beg to differ with him this time. Very few persons, except chemists, may be supposed to have solutions of either blue or green vitriol always at hand; and even a chemist, unless notified to this effect beforehand, would not think to try the effect of these solutions until he had tried several other reagents. This could be remedied by writing on the back of the card with common black ink an ambiguous or nonsensical sentence containing the name of the developer to be employed. For chemists, a convenient ink would be a solution of some lead salt, which is developed by sulphuretted hydrogen.

For ordinary use the most convenient ink is an iron salt; the common tincture of iron of the drug store will answer, if diluted. This writing is scarcely perceptible when dry, but comes out a beautiful black on pouring over it some ordinary green or black tea. The tannin in the tea unites with the iron to form a black ink precisely like that used for ordinary correspondence.

Another ink, less convenient for the writer, but more convenient for the receiver, is to write on the card with thin starch paste. When perfectly dry, the card is flowed with a solution of iodiné in very strong alcohol. This imparts a reddish color to the card, but does not develop the writing, owing to the absence of water. The receiver has only to dip the card in water, when the writing will appear in blue characters. We offer this as a suggestion to manufacturers of magic inks. Of course, the operation of flowing with tincture of iodine might be left for the person who receives it, provided he were furnished with a key to the developer required. In this case dilute alcohol, or a solution of iodide of potassium, could be employed as a solvent for the iodine.

Another method, more curious than useful, consists in writing on the card with a solution of paraffin in benzol. When the solvent has evaporated the paraffin is invisible, but becomes visible on being dusted with lampblack or powdered graphite, or smoking over a candle flame. H.

Antidote for Oidium on Grape Vines.

M. Chatot, a Frenchman, recommends common table salt as an antidote for oidium, or grape vine disease. He says that his vines and grapes were covered for some years with a fungus-like substance, and that last spring he sprinkled a handful of salt about the roots of each vine. The effect was marvellous, the vines grew luxuriantly, and bore an abundance of grapes entirely free from the fungus of oidium.

NEW BOOKS AND PUBLICATIONS.

THE ELEMENTS OF MACHINE DESIGN. An Introduction to the Principles which Determine the Arrangement and Proportions of the Parts of Machines, etc. By B. Cawthorne Unwin, Professor of Mechanical Engineering at the Royal Indian College of Civil Engineers. Price 3s. 6d. (84 cents gold). London, England: Longmans, Green & Co., Paternoster row.

The designing of machinery has hitherto been principally left to the draftsmen, and no attempt has been made until recently to reduce their different practices and methods to a science; and although it might be easy to form a collection of rules deduced from actual practice, no principles could be laid down on the authority of such empirical formulæ. To systematize the whole subject, and thus to simplify the practice and render it easy of acquisition by students, is the author's object, and he has succeeded in completing a work of the highest excellence. The chapters on materials and strength of materials, on riveted joints, and on shafting, are especially to be noticed for their terse and clear explanations; and throughout the book the mathematical expressions used need not deter any careful and painstaking student by their depth and abstruseness. The author has evidently put into this volume an amount of practical knowledge which must have taken many years to acquire.

THE MICROSCOPIST. A Manual of Microscopy. By J. H. Wythe, M.D. Third Edition. Illustrated. Price $4.50. Philadelphia, Pa.: Lindsay & Blakiston, Publishers. New York city: D. Van Nostrand, 27 Warren street.

Professor Wythe offers a practically new work, since he has retained nothing but the name and perhaps the general design of his earlier elections. The present book is in all respects creditable both to the author and the publishers; and we can cordially commend it to students of microscopy. It abounds in clear, practical suggestions; its descriptions of microscopic objects and their mode of preparation are exceedingly lucid; while an abundance of admirable illustrations is provided. Beginning with a description of the various forms of microscope, the author explains all the accessories, mechanical arrangements, etc., including the microspectroscope and the practice of micro-photography; chapters on the use of the instrument and how to prepare objects follow, and then the several applications of the instrument, as a means of investigation in the various sciences, are separately and fully considered.

THE LIFE HISTORY OF OUR PLANET. By William D. Gunning. Illustrated by Mary Gunning. Chicago, Ill.: W. B. Keen, Cooke & Co.

A popular and readable work on a subject which is calculated, better than any other we know of, to test an author's powers of discrimination. We can give Mr. Gunning credit for presenting his views in a new way, and can heartily commend the progressive manner in which he leads the reader from the simpler to the complex subjects. Besides, all the book has a timely value, because many recent discoveries—notably those of Professor Marsh and the deep sea expeditions—are explained in popular form, and are brought into their proper connection with the history of the world.

A PRACTICAL TREATISE ON HEAT. By Thomas Box. Price $5. New York city: E. & F. N. Spon, 446 Broome st.

The second edition of an excellent standard work. It takes account of all the recent advances in the science, embodies a large number of the tables which enter into the daily practice of mechanical engineers, and, in brief, is a handbook, a thorough knowledge of the contents of which would be invaluable to any one in a mechanical profession. We can commend it to the many correspondents who frequently ask us what books young engineers should study.

CELESTIAL DYNAMICS. By James W. Hanna. Price 30 cts.

The author, who says he knew nothing about astronomy a year ago, now undertakes to upset the science by affirming the non-revolution of planets about the sun.

FIRES IN THEATERS. By Eyre M. Shaw, R.E., Chief of the London Fire Brigade. Price 50 cents. New York city: E. & F. N. Spon, 446 Broome street.

A very sensible treatise on an important subject, by a writer of great knowledge and experience.

On page 359, volume XXVI., we described and illustrated Mr. C. Baillarge's new system of mensuration. We are in receipt of a "Key to Baillarge's Stereometrical Tableau," relating to the same subject. Published by C. Darveau, 82 Mountain Hill, Quebec, Canada.

"Cleaning and Scouring" is the title of a handy little book of recipes for laundresses and others. Published by E. & F. N. Spon, 446 Broome street, New York city. Price 20 cents.

DECISIONS OF THE COURTS.

Supreme Court of the United States.

LEATHER PATENT.—NATHAN C. RUSSELL, APPELLANT, *vs.* SAMUEL DODGE, SR., AND SAMUEL DODGE, JR.

[Appeal from the Circuit Court of the United States for the Northern District of New York.—Decided October Term, 1876.]

Where a useful result is produced in any art, manufacture, or composition of matter, by the use of certain means for which the inventor or discoverer obtains a patent, the means described must be the essential and absolutely necessary means, and not mere adjuncts, which may be used or abandoned at pleasure.

Where a reissued patent is granted upon a surrender of the original, for its alleged defective or insufficient specification, such specification cannot be substantially changed in the reissued patent, either by the addition of new matter or the omission of important particulars, so as to enlarge the scope of the invention as originally claimed. A defective specification can be rendered more definite and certain so as to embrace the claim made, or the claim can be so modified as to correspond with the specification; but, except under special circumstances, this is the extent to which the operation of the original patent can be changed by the reissue.

Where the patent was for a process of treating bark-tanned lamb or sheep skin by means of a compound, in which heated fat liquor was an essential ingredient, and a change was made in the original specification by eliminating the necessity of using the fat liquor in a heated condition, and making in the new specification its use in that condition a mere matter of convenience, and by inserting an independent claim for the use of fat liquor in the treatment of leather generally, the character and scope of the invention as originally claimed were held to be so enlarged as to constitute a different invention.

The action of the Commissioner of Patents in granting a reissue within the limits of his authority is not open to collateral impeachment, but his authority being limited to a reissue for the same invention, the two patents may be compared to determine the identity of the invention. If the reissued patent, when thus compared, appears on its face to be for a different invention, it is void, the Commissioner having exceeded his authority in issuing it.

The case of Klein *vs.* Russell, reported in the 19th of Wallace, stated and qualified.

Mr. Justice Field delivered the opinion of the court:

This is a suit for an infringement of a patent obtained by the complainant for an alleged new and useful improvement in the preparation of leather, with a prayer that the defendants be decreed to account for and pay to him the gains and profits derived by them from making, using, and vending the improvement, and be enjoined from further infringement. The patent bears date in February, 1870, and was issued upon a surrender and cancellation of a previous patent obtained by the complainant in August, 1869, upon the allegation that the original patent was inoperative and invalid by reason of an insufficient and defective specification of the improvement. The validity of the reissued patent is assailed on the ground that it describes a different invention from that claimed in the original patent, and for want of novelty in the invention. Other grounds of invalidity are also stated, but in the view we take of the case they will not require consideration.

In the schedule accompanying the patent, giving a description of the alleged invention and constituting a part of the instrument, the complainant declares that he has "invented a new and useful improvement in the preparation of leather;" that "the invention consists in a novel preparation of what is known as bark-tanned lamb or sheep skin," by which the article is rendered soft and free, and adapted, among other uses, for the manufacture of what are termed "dog-skin gloves;" and that "the principal feature of the invention consists in the employment of what is known among tanners and others as 'fat-liquor,' which is ordinarily obtained by scouring deer skin after tanning in oil," but which may be produced by the cutting of oil with a suitable alkali. The schedule then proceeds to state that in treating the leather with fat liquor "it is *desirable* to heat the liquor to or near the boiling point; and that it is *preferred* to use the same in connection with other ingredients," such as soda, common salt, and soap in specified quantities for each ten gallons of the heated liquor; and that "to effect the treatment" the skin should be well dipped in or saturated with the fat liquor or compound, of which fat liquor is the base. The schedule closes by a declaration that what the patentee claimed and desired to be secured by letters patent was:

1. The employment of fat liquor in the treatment of leather, substantially as specified.

2. The process, substantially as herein described, of treating bark-tanned lamb or sheep skin by means of a compound composed and applied essentially as specified.

It is clear from this statement that the patent is for the use of fat liquor in any condition, hot or cold, in the treatment of leather, and for a process of treating bark-tanned lamb or sheep skin by means of a compound in which fat liquor is the principal ingredient. The state of the liquor is not mentioned as essential to the treatment, or to accomplish any of the results sought. It is only stated as a thing to be *desired* that the liquor should be heated, and that it would be *preferable* that other ingredients were mixed with the heated liquor to make the compound mentioned. In other words, the specification declares that by heating the liquor the effect desired will be more readily produced—that is, more speedily or with less trouble and expense; not that the heating is in any respect essential to the treatment. Where an useful result is produced in any art, manufacture, or composition of matter by the use of certain means for which the inventor or discoverer obtains a patent, it is, as justly observed by the presiding justice of the circuit court, too plain for argument that the means described must be the essential and absolutely necessary means, and not mere adjuncts which may be used or abandoned at pleasure.

The original patent was less extensive in its claim than the reissue. That patent was for a process of treating bark-tanned lamb or sheep skin by means of a compound, in which heated fat liquor was an essential ingredient. The specification was explicit in this particular, and left no doubt on the subject. The reissued patent covers the use of the fat liquor in any condition, hot or cold, and when used alone or in a compound with other ingredients, and thus has a more extended operation, bringing under it manufactures not originally contemplated by the patentee. Is such a reissue valid?

The statute of 1836 (2 Statutes at Large, 122), under which the reissue was granted, provided that whenever any patent was inoperative or invalid by reason of a defective or insufficient description or specification, or by reason of the patentee claiming as his own invention more than he had a right to claim as new, if the error arose from inadvertence, accident, or mistake, and without any fraudulent or deceptive intention, it should be lawful for the Commissioner, upon the surrender of such patent and the payment of a prescribed duty, to cause a new patent to be issued to the inventor for the *same invention*, for the residue of the period then unexpired, in accordance with the corrected description and specification.

According to these provisions a reissue could only be had where the original patent was inoperative or invalid, by reason of a defective or insufficient description or specification, or where the claim of the patentee exceeded his right, and then only in case the error committed had arisen from the causes stated. And as a reissue could only be granted for the same invention embraced by the original patent, the specification could not be substantially changed, either by the addition of new matter or the omission of important particulars, so as to enlarge the scope of the invention as originally claimed. A defective specification could be rendered more definite and certain so as to embrace the claim made, or the claim could be so modified as to correspond with the specification; but except under special circumstances, such as occurred in the case of *Lockwood & Morey* (8 Wall., 230), where the inventor was induced to limit his claim by the mistake of the Commissioner of Patents, this was the extent to which the operation of the original patent could be changed by the reissue. The object of the law was to enable patentees to remedy accidental mistakes, and the law was perverted when any other end was secured by the reissue.

Judged by that law, and the provisions of the act of 1870 on this subject are substantially the same, there can be no doubt of the invalidity of the reissue. The original patent was not inoperative nor invalid from any defective or insufficient specification. The description given of the process claimed was, as stated by the patentee, full, clear, and exact, and the claim covered the specification—the one corresponded with the other. The change made in the old specification by eliminating the necessity of using the fat liquor in a heated condition, and making in the new specification its use in that condition a mere matter of convenience, and the insertion of an independent claim for the use of fat liquor in the treatment of leather generally, operated to enlarge the character and scope of the invention. The evident object of the patentee in seeking a reissue was not to correct any defects in specification or claim, but to change both, and thus obtain, in fact, a patent for a different invention. This result the law, as we have seen, does not permit.

The decision of the Commissioner in granting the reissue is, it is true, so far conclusive as to preclude in the present suit for infringement any inquiry into its correctness outside of the patents themselves. His action in any case, within the limits of his authority, is not open to collateral impeachment. But that authority being limited to a reissue for the same invention as that embraced in the original patent, a reissue for anything more is necessarily inoperative and void. To determine the identity of the invention the two patents may be compared. Thus compared, the reissue here appears on its face to be for a different invention, and the Commissioner, therefore, exceeded his authority in issuing it. (Seymour *vs.* Osborne, 11 Wall., 544; Wicks *vs.* Stevens, 2 Wood's C. C. Reports, 312.)

In the case of Klein *vs.* Russell (19 Wall., 463), the question was not before the court whether the reissued patent was invalid because not for the same invention. The point was not made in that case in the court below, and for that reason, it was stated, the point could not be made here. It was to be presumed, said this court, until the contrary was made to appear, that the Commissioner did his duty correctly in granting the reissue. What was subsequently said of the character of the first claim, so far as it conflicts with the construction here given, does not meet our approval after the extended consideration the subject has since received.

But assuming that the reissue is not void for the reasons stated, the patent is still invalid for want of novelty in the alleged invention. The use of fat liquor in the treatment of bark-tanned skins was general with manufacturers for many years previous to the alleged invention. Testimony to this effect is given by numerous witnesses. It would subserve no useful purpose to state this testimony. It is set forth with ample fullness in the opinion of the circuit court. It is sufficient for us to say that it is entirely satisfactory to our minds.

The decree is affirmed.

United States Circuit Court—District of Connecticut.

BOLT PATENT.—WILLIAM J. CLARK *vs.* THE KENNEDY MANUFACTURING COMPANY AND EDWIN HILLS.

[*In Equity.—Before* SHIPMAN, J.—*Decided January* 1, 1877.]

The invention described in the original patent to Wm. J. Clark, February 2, 1864, consists in the manner in which he applied lateral compression to the manufacture of an angular neck, and in the manner in which he permitted the shaping mechanism to become anvil ends, upon which the header could operate to form a head upon the bolt.

He did not discover that swaging round iron would form an angular neck, and that upsetting would form a head, and that both operations would form a bolt; but he did invent what was before unknown—the mechanical means by which swaging would form an angular neck from round iron, which mechanism could be used in connection with upsetting.

The thing invented and patented was not any mode of swaging combined with upsetting; but it was the employment of specified means, or their equivalents, for the accomplishment of a desired end.

A patentee cannot, by obtaining a reissue for a process, enlarge his right to a monopoly beyond the actual invention.

The claims for the process of forming the angular neck and protuberant head, as contained in the reissue, construed to be to the use substantially of the dies described in the specification, or their equivalents.

The patent covers dies constructed with the round and square portions of similar area, whereby the lateral swaging is effected before the header operates; and it is not infringed by the use of dies, the square portion of which is of greater area than the round, and the swaging and upsetting operations are simultaneously performed.

The claim in the reissued patent does not include any machine for making bolts from round iron, in which machine the two operations of forming the angular neck by dies which will swage, and forming the head by upsetting, are combined.

Claims should be so construed, if possible, as to embrace the invention actually made and described.

Bill dismissed.

[*Chas. E. Mitchell* and *Benj. F. Thurston* for plaintiff.
Chas. R. Ingersoll for defendants.]

United States Circuit Court—District of Massachusetts.

WATER WHEEL PATENT.—THE SWAIN TURBINE AND MANUFACTURING COMPANY *vs.* JAMES E. LADD.

[*In equity.—Before* SHEPLEY, *J.:—Decided January* 2, 1877.]

Claims which would be void as being functional should be so construed as to embrace the described means for effecting the result.

When changes of form involve functional differences, producing new or better results, they are patentable.

The claims in a reissued patent are to be construed so as not to embrace any invention broader in its scope than the invention described, or substantially suggested or indicated in the original.

ABSTRACT FROM THE OPINION OF THE COURT.

SHEPLEY, J.:

The reissued patent No. 28,314, dated November 19, 1872, has its first, second, third, and fifth claims so worded as in their broad and literal construction, without any limitation to the invention described in the specifications of the original and the reissued patent, to claim any form of "water wheel having an effective inward flow and discharge of part of the water, and an effective downward flow and discharge of part of the water simultaneously in one wheel, whereby the effective area of discharge is increased without increasing the diameter of the wheel" This is the exact language of the fifth claim, which would be void as a claim merely functional, unless this claim be construed as must also the first, second, and third claims, as including the described means of effecting the result. To uphold these claims they must not only be construed in connection with the described means in the reissue, but so construed as not to embrace any invention broader in its scope than the invention described, or substantially suggested or indicated, in the original. However meritorious and original the invention of Swain was (and of its originality and merit as an advance in the state of the art at the date of Swain's invention, the court does not entertain any doubt), nevertheless, its great merit and utility will not justify such broad claims in a reissue as shall effectually interpose a barrier in the path of subsequent inventors, and arrest the progress of invention. The broad language of these claims, liberally construed, eliminates from the combination in the reissue the downward and inward curvature of the crown which forms an essential functional element of the combination in the original. Such a literal construction of these claims, with the scope contended for by the complainants, would render the reissue void, according to the decisions in Wells *vs.* Gill, and many other cases decided by the Supreme Court of the United States, including Seymour *vs.* Osborne. In this connection the court can only repeat the language of the opinion in Forsyth *vs.* Clapp (1 Holmes).

The court will look beyond the mere form of words in the claim of a reissued patent into the specifications in both the original and reissued patents; and, even if on the face of the reissued patent it does not embrace anything not described or suggested in the original, nevertheless the court will ascertain whether there is any substantive invention adequate to support a claim ingeniously worded, not so much for the purpose of describing what the patentee really invented as of grasping within its terms some contrivance not within the knowledge or contemplation of the patentee, and for that reason, not by inadvertence or mistake, not embraced in the claims of the original patent.

Giving to these claims the construction which we have indicated, the word crown in the first three claims will refer to and include in the combination such a crown as is described in the original patent and represented in the drawings of the original and the reissue, and the fifth claim will be limited in its scope to water wheels possessing such elements as we have hereinbefore recited as the described essential component parts of the turbine wheel described in the specifications and drawings of the original patent. Giving this construction to the claims, the defendant does not infringe, and the bill must be dismissed.

[*J. S. Abbott* and *H. W. Boardman*, for complainants.
Browne & Holmes and *C. E. Mitchell*, for defendant.]

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Recent American and Foreign Patents.

NEW HOUSEHOLD INVENTIONS.

IMPROVED COAL SCUTTLE.

William Richards, Woodhull, Ill.—This consists of a scoop or body of peculiar form, set angularly in a base piece or hoop, the object being to provide a scuttle which may be easily manufactured.

IMPROVED IRONING TABLE.

Edward H. Caylor, West Elkton, O.—This ironing table is so constructed that it may be attached to a table, and may be supported at any desired height, may have a shirt board and a sleeve board attached to it. It is provided with a clothes-rack and a stand for the sad irons.

IMPROVED DISH WARMER.

Nathan Clark, New York city.—In using this device, an iron plate is warmed to the desired temperature by being placed upon the stove, and is then inserted in a painted wooden holder. The dish to be kept warm is placed upon it, and the whole is then placed upon the table.

IMPROVED TEA KETTLE.

Leonard A. White and George W. Lewin, North Dighton, Mass., assignors to themselves and Joseph B. Warner, of same place.—This invention consists of a laterally sliding and guided lid, secured in closed position by a spring catch of its handle to a lug of the kettle; and it consists, further, of flattened off parts or seats of the bottom, body, and spout of the kettle, to support the same in inclined position. The last mentioned device steadies the kettle, and facilitates the pouring of the contents, dispensing with the annoying lateral motion or oscillation of the kettle caused by the pivoted handle.

IMPROVED CARPET SWEEPER.

Henry A. Gore, Goshen, and George W. Edgcomb, Lima, Ind.—This consists in a combination of levers with the driving wheels of the sweeper by means of which the said wheels are thrown into contact with an intermediate friction roller attached to the rotating brush when a downward pressure is exerted on the said driving wheels. The advantages claimed are that the device is noiseless in its operation and the automatic adjustment of the driving wheels insures a positive motion of the brush.

IMPROVED COMPOUND VALVE FOR WASH BASINS, ETC.

Francis E. Kernochan, Pittsfield, Mass.—The object of this invention is to prevent sewer gas from escaping into the house through the discharge pipes of wash basins, bath tubs, watercloset basins, etc. It consists in the combination of two or more valves, fastened side by side upon a common support and operated by a single shaft, stem, or lever, the latter being made to pass through all the valves and open or close all of them at once by a part or whole revolution.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED DEVICE FOR SECRET WRITING.

Alexander Berghold, New Ulm, Minn.—By this device or key, short messages can be written by a correspondent to another who has a device or key similarly constructed and arranged, by means of which the message can be promptly read and understood, or copied, but cannot be possibly understood by any other person not provided with the key, and this invention consists in an alphabet, the different letters of which are printed, engraved, or marked upon strips of metal, paper, etc., that are interchangeable, and can be transposed, one for the other, the strips having a perforation for each letter, through which a dot, puncture, or mark can be placed upon paper or other suitable material to indicate a special letter or symbol, according to the position that it occupies in the message. The inventor states that the apparatus measures about ½ by 1¼ inches by 1/12 inch thick, is made of metal, and can be sold for 50 cents, and that the use of it can be learnt in a few minutes.

IMPROVED POCKET KNIFE.

William R. Rightor, Helena, Ark.—This design unites in a single knife case, together with the usual cutting blades, a detachable whetstone for sharpening the latter, and also a saw blade, having a right angular side rasping surface. The handle of the knife easily carries in one of its side pieces the independent whetstone, instead of the bone, ivory, or other piece usually secured fixedly therein, and this stone can be quickly used by turning back the saw blade, with its rear flange, and thus allowing the stone to be slid out from its supporting seat, and used independently of the handle.

IMPROVED PARALLEL RULER.

Eugene J. Towne, North Dana, Mass., assignor to himself and J. W. Goodman, of same place.—This is an improved T-square that combines the advantage of a common and bevel square with a parallel ruler admitting parallel shading at any position of the blade in a convenient manner. There is also an adjustable blade, sliding by its head in a recessed guide-piece, attached to the drawing board. The guide piece carries in end brackets a longitudinal screw shaft that is operated by a thumb rest, ratchet, and pawl, and an adjustable stop device, so as to move the blade by a split locking nut at equal distances for parallel ruling.

IMPROVED EXTENSIBLE SHAWL STRAP BAR.

Lyon Lewine, Brooklyn, N. Y.—This consists in a shawl strap bar so constructed as to be capable of extension and contraction to enable it to be adjusted to correspond in length with the length of the package to which it is to be applied. It is formed by the combination of the middle part, having T-grooves upon its lower side, and provided with the stop pins with end parts rabbeted upon their side edges, and provided with the longitudinal grooves.

IMPROVED HAME FASTENER.

John C. Moore, Chicago, Ill., assignor to himself and James A. Doran, of same place.—This invention consists of a strap attached by a long loop to one hame section, and passed through a staple of the other hame section, being secured by an eccentric and toothed cam and lever. It is locked in position by a link running in the long loop, and retained by a spring in a groove of the lever.

IMPROVED ADVERTISING DEVICE.

William A. Brice, London, England.—The object of this invention is to provide a mode of exhibiting advertisements automatically by the dropping of one or more coins in an aperture provided for the same, while at the same time the coins, after effecting their work, drop into the till or cash box placed underneath for their reception. The device was described and illustrated on p. 134, vol. 36.

IMPROVED GRAIN DRYER.

José Guardiola, Chocolá, Guatemala.—By means of a machine, which we described and illustrated on p. 82, vol. 36, the grain or coffee is constantly agitated while it is subjected to the influence of hot air, which permeates the entire cylinder, the said apparatus being supplied with heated air by any of the ordinary well known means.

IMPROVED QUILTING FRAME.

Frances M. Tousley, Lincoln, Neb.—This consists of a quilting frame composed of rails made of hinged pieces, that are stiffened at the joints by locking hook and eyes, and connected at the corners by flanged metallic seats and fastening thumb screws. By loosening the hooks of parallel rails the frame and quilt may be folded; by detaching the rails and loosening all the hooks the entire frame may be folded up.

IMPROVED SHOE FASTENER.

William J. Brown, New York city.—This relates to shoe fasteners designed to take the place of the ordinary buckle or lacing; and it consists of a hasp attached to the flap of a shoe, and a double spring catch or bolt attached to the side of the shoe for engaging the hasp.

IMPROVED SOAP COMPOSITION.

John W. Bartlett, Moline, Ill., assignor to himself and M. Witherell, of same place.—This is a machine soap, formed of rain water, pulverized lime, soapstone, carbonate of potash, chloride of lime, concentrated lye, golden machine oil, cotton seed oil, lard oil, and melted lard.

IMPROVED STRAINER CUP.

Jacob W. Oberholtzer, Hiawatha, Kan.—This is an improved strainer cup, by which the patients may drink without raising their heads and spilling the contents, and by which toast water, beef tea, and other fluids may be strained before passing to the cup, without requiring an extra straining cloth for this purpose. The invention consists of a cup with small discharge spout at one end, and a detachable strainer section at the other end.

IMPROVED AUTOMATIC RELIEF VALVE FOR CASKS.

Addison Smith, New York city.—This is an improved valve designed especially for casks containing beer and other fermenting liquids, but which may be used for other purposes. It is so constructed as to open and allow the inclosed gas to escape when the outward pressure rises above a certain point. It is easily adjusted to resist any desired pressure before opening.

IMPROVED FIRE ESCAPE.

Jules A. Tixier, Brooklyn, N. Y.—This device consists of a frame which is firmly fitted in the window, and the upper part of which projects outward. In said upper part are cylinders, around which the two lowering ropes pass. Each rope carries a chair, and makes two or three turns around one of the cylinders. Both of the cylinders are acted upon by springs, so the ropes may be lowered with their load quite slowly.

IMPROVED CIGAR BOX AND CIGAR BOX CATCH.

Ferdinand Hasselbach and Ernst Hasselbach, Brooklyn, N. Y.—The first invention relates to such an improvement in cigar boxes with hinged front sections that the lateral sides are retained rigidly in position when the cigars are packed and pressed into the boxes. The box has a hinged front part, which is connected to the sides by pivoted clasps fitting into the recesses of the front part for locking the same, and strengthening the sides against spreading in lateral direction. The second invention consists of a swinging hook, that is pivoted by a U-shaped strip into a cross slit or recess of the front wall of the cigar box, and arranged to engage the bent and recessed part of a top strip of the lid in a recess of the latter.

IMPROVED VENTILATING FAUCET.

Ole H. Larson, Fort Dodge, Iowa.—This invention consists in a faucet in which the plug, and cylinder which contains it, are provided with an aperture for admitting air to a tube that runs lengthwise through the faucet to its inner end. A check valve is there provided which admits air to the cask when the faucet is opened, but prevents the exit of beer through the air pipe. The invention also consists in placing the plug of the faucet below its main body, so that, in driving the faucet into a cask, it will not become battered, so as to leak.

IMPROVED SCHOOL SEAT.

James Page Clair, Philadelphia, Pa.—In this invention a lateral stud on the side of the short arm of the seat support works in a curved slot of the standard between rubber spring buffers at each end to relieve the shocks, and render the seat noiseless. The stud hooks around the wall of the slot to support the pivot.

IMPROVED BOB SLED.

Alfred L. Needham and Edward Z. Needham, Farmington, Minn.—This bob sled is so constructed that it will readily adjust itself to any position required by the inequalities of the path, without undue strain upon any of its parts.

IMPROVED FARE REGISTER.

William Stokes, New York city.—This is a device for indicating fares received on street cars. Each fare is indicated by a stationary hand on a revolving dial, together with the sound of a bell provided for such purpose, so that each passenger may have a check on the conductor.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED WATER CLOSET.

Michael J. McEwan, New York city.—This consists in the arrangement of a sliding valve at the bottom of a closet-bowl, for dropping the contents of the bowl into the trap, and for preventing the rising of effluvia from the trap or sewer below.

IMPROVED WATER CLOSET.

George R. Kuhn, Brooklyn, N. Y.—Directly above the bowl is arranged a supplementary lid, which is preferably made of two semi-sections, that overlap at their meeting edges, and are lined with rubber to form a hermetically sealing joint. The connecting lever mechanism is provided with weights or springs, that serve to close the lid sections automatically as soon as the pressure on the seat or treadle is released. In this way escape of bad odors is prevented.

IMPROVED CHIMNEY DAMPER.

Thomas Speed, Louisville, Ky.—This is an improved damper for the throat of a chimney at the top of a grate front, to enable the said throat to be nearly closed after the fire is fully kindled to prevent the warm air from the room from passing off up the chimney.

IMPROVED APPARATUS FOR VENTILATING DRAIN PIPES, ETC.

Edward G. Banner, London, England.—This invention has for its object to prevent the passage of sewage gas into dwellings from soil pipes, drains, cesspools, or sewers. For this purpose a trap is placed at the lower end of the soil pipe, which latter is carried up to the top of the house, and there left open to form an inlet for fresh air; and to the soil pipe, just above the trap above mentioned, a ventilating pipe (which may be of smaller diameter than the soil pipe) is connected, which is also carried up to the top of the house, and has upon it a ventilating cowl, so constructed that the passage of a wind through it shall produce at all times a continuous current of air from the inlet through the soil pipe and out at the cowl; or, by a slight modification, the direction of the current of air in the soil pipe may be reversed by placing the ventilating cowl upon the top of the soil pipe itself, and providing an inlet of air to the soil pipe, just above the trap, or in the upper part of the trap itself.

NEW AGRICULTURAL INVENTIONS.

IMPROVED CULTIVATING PLOW.

Thomas T. McAllister and William W. McDonald, New Albany, Miss.—This implement is so placed as to straddle the row of corn or cotton plants, and thus cultivate the ground on each side thereof. Blocks run on the surface of the ground, and serve to push gradually toward the plants a portion of the earth loosened or thrown up by the colters, which work immediately in advance of them. The weeds and grass are covered by the earth thus thrown upon them, and their destruction thereby effected, while the earth immediately contiguous to the roots of the plants is not disturbed.

IMPROVED PLOW.

Jacob Ruch, Mount Eaton, assignor to himself and William M. Johnston, Wilmot, O.—This plow is so constructed that it may be readily adjusted to work deeper or shallower in the ground, and to take and leave land, as may be desired. By loosening the nut upon the upper end of the bolt attached to the standard, the forward end of the plow beam may be raised and lowered to adjust the plow in the ground, as may be required. By a simple regulating of nuts the plow beam may be adjusted vertically or laterally.

IMPROVED CHURN.

George W. Knapp, Arbuckle, W. Va.—Dasher rods are fixed to the dashers and connected to cranks diametrically arranged on the shaft by connecting rods. Said dashers are guided between grooved friction rollers. These rollers, at one side of the dasher rod, are supported by a hinged frame, by which they may be thrown back out of the way when the dashers are to be removed from the churn. When the frame is closed down on the cross piece that supports it, a catch is caused by the spring to engage with a pin in the cross piece.

IMPROVED CIDER PRESS.

Russell C. Quinn, Texas Valley, N. Y.—The working of this invention is based on the principle of the endless chain, receiving continuous charges of pomace from the grinder for pressing and discharging the same without interruption. The chain carries a number of spring-acted sacks resting on slat bottoms and revolving in connection with a charging grinder, and with a simultaneously revolving follower belt. The device is guided in proper manner to register with the pomace sacks and press the juice on to an inclined spout below, while the end sacks are discharging their contents.

IMPROVED SEED PLANTER.

Jacob R. Sample, Liberty, Miss., assignor to himself and William P. Anderson, of same place.—This machine is so constructed that it may be readily adjusted to plant corn, peas, and other smooth seeds, and to plant cotton seed and distribute fertilizers. The invention consists in the leather strap provided with the radial spikes or pins, in combination with the grooved dropping cylinder and the slotted lower end of the hopper. The pins pass through slots in the lower part of the hopper, so as to take hold of the fertilizer, drawing the same from the hopper, and allow the fertilizer to drop to the ground.

IMPROVED HARVESTER.

Ole S. Knudson, Houston, Minn.—This machine is so constructed that it may be run at less speed than the ordinary machine, and may thus be more durable and of lighter draft. To the axle is attached the drive wheel, which by gear wheels actuates a shaft. The latter revolves in bearings attached to the frame, has a crank formed upon its middle part, and a weighted arm attached to its inner end. The crank and the weighted arm project in opposite directions to balance each other. The crank, by connecting rods and an elbow lever, communicates with the sickle bar. The arms of the lever are made of such a relative length that the sickles attached to the sickle bar may move through the space of, and cut the grain against, two of the fingers attached to the cutter bar, and the fingers hold the stalks until they are cut.

IMPROVED PLOW.

Gideon Black, Dadeville, Ala., assignor to himself and John T. Moye, of same place.—This plow is so constructed that it may be readily adjusted to work deeper or shallower in the ground. The handles and braces move upon their pivots when the standard is adjusted, and will be held firmly in place when the standard is locked.

IMPROVED TILTING GATE.

Isaac Brokaw, Litchfield, Ill.—This consists of a swinging and weighted gate that swings in fulcrums of the gate posts, and is opened or closed by a suitable cord arranged to withdraw a spring latch for raising the gate, and also to release a brake spring for lowering.

IMPROVED SELF-ADJUSTING TREE SHIELD.

Almon Roff, Southport, Conn.—To prevent the millers from having access to the trees, this inventor incloses the lower part of the trunk with a sheet of lead bent around the tree, and made of such a length that its sides may overlap each other sufficiently to allow for two or three years' growth of the trees. The shield is coiled so closely around the trunk that the millers cannot pass down between it and the trees, and is kept from contact with the tree by thin strips of wood interposed between it and the said tree. As the tree grows, the lead will expand and so adjust itself.

IMPROVED INSECT DESTROYER.

George B. Drum, Syracuse, Neb.—This consists in a vehicle containing a combined catching and destroying mechanism, to be drawn about the fields for the purpose of ridding them of noxious insects. The insects passing over a brush are drawn through rolls and killed, falling upon the ground. Wings are provided to catch the insects and prevent their flying over the machine and escaping.

IMPROVED SEED PLANTER.

Benjamin F. Miller, Gatesville, Tex.—This is an improved machine for planting cotton, and also for planting corn and other smooth seed. New devices are included whereby the pitch of the plow may be changed as desired; and the ends of the beams of the covering plows are received in clevises attached to the ends of a bar which is secured to the frame.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED STEAM TRAP AND BOILER FEEDER.

Bennett Vandecar, Canajoharie, and Henry V. Harper, Albany, N. Y.—This relates to floats to be used for controlling the supply of water to a tank or boiler. It consists of a float-ball having a tubular lever, provided with an outside connection for the escape of water that may sweat or condense in the ball. It also consists in a vent tube running through the tubular lever for the admission of air to the float ball, and also in an improved valve attached to the float lever for closing the inlet pipe of the tank or boiler.

IMPROVED DOUBLE-ACTING PRESS.

Louis Prahar, New York city.—This is an improved foot motion press so constructed as to cut out a blank with the rearward motion of the foot lever, and, by the forward motion of said foot lever, to carry the said blank to a die and press it to the desired form.

IMPROVED ROTARY ENGINE.

Robert W. Skirrow, Windsor, Conn.—This invention relates to the construction and arrangement of the valves and sliding abutments and the means for operating them. Said means consist in tappet arms keyed on rock shafts and eccentrics keyed on the shaft of the engine, and connected with the rock shafts by means of bars or rods. The tappet arms engage notches formed in the under side of the curved arms of the valves.

IMPROVED MACHINE FOR GALVANIZING TERNE PLATES.

John D. Jones and John Gape, Audenried, Pa.—This consists of an iron receptacle for the melted metal, in which two sets of rollers are placed, which are actuated by a spur wheel, which meshes into pinions on the roller shafts. An inclined guide plate extends down to the rollers; this, together with a table between the sets of rollers, and an inclined guide plate beyond, forms a way on which the plates or hoops move into and out of the melted metal. Another pair of rollers is placed at the end of the last mentioned plate to remove the superfluous metal.

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Shingle Heading, and Stave Machine. See advertisement of Trevor & Co., Lockport, N. Y.

For Solid Wrought iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Notes & Queries

J. M. L. will find directions for making soap on pp. 331, 379, vol. 31. To make vinegar, read the instructions on p. 106, vol. 32.—R. B. C. will find directions for making printers' rollers on p. 283, vol. 31.—B. C. M.'s question relates to proportional compasses, to be purchased of any dealer in drawing instruments. Copper plates may be flattened by following the instructions on pp. 149, 181, vol. 36.—A. J. R. will find a recipe for hair dye on p. 138, vol. 27.—J. F. should read our articles on straightening metal plates on pp. 149, 181, vol. 36.—J. C. G. will find directions for making fulminate of mercury on p. 90, vol. 31.—T. P. H. can make a metal stamp by running type metal into a plaster mould containing the required device.—J. F. M. is informed that crude gutta percha usually contains dirt and other impurities. A cement for leather is described on p. 171, vol. 35.—S. S. K. will find directions for reducing tin scrap on p. 319, vol. 31.—H. L. is informed that the details of Mr. Lowthian Bell's method of making iron rails have not yet reached us.—C. R.W. will find instructions for making lightning rods on p. 277, vol. 35.—J. W. can frost the surface of glass by following the directions on p. 281, vol. 33.—A. will find a description of the postage stamp manufacture on pp. 208, 277, vol. 27.—T. J B. will find something on tanning birds' skins on p. 187 vol. 36.—S A. H. will find something on constructing Rhumkorff coils on p. 219, vol. 32.—J. A. C. will find two articles on the blue glass deception on pp. 129, 145, vol. 36.—J. J. will find a recipe for blue ink on p. 257, vol. 32; for green ink on p. 27, vol. 30.—W. S. will find directions for moulding rubber on p. 203, vol. 35. For giving a black finish to rubber, see p. 122, vol. 30.—J. L. is informed that he can make good soap moulds of pewter.—C. S. C. will find directions for polishing brass on p. 298, vol. 29. For a varnish for brass, see p. 310, vol. 35.—F. G. T. will find directions for making printers' rollers on p. 283, vol. 31. To make rubber hand stamps, see p. 203, vol. 35. For transfer paper, see p. 378, vol. 28.—A. L. W. will find directions for brazing metal plates together on p. 347, vol. 30.—T. H. B. will find something on the extraction of vanillin from pinewood on p. 18, vol. 35.—W. A. M. can paint his model with black paint and varnish with shellac in alcohol.—H. R. F. is informed that lead pipe is made by forcing lead through a hole in a metal plate in which a core is inserted.—W. Y. G., M. A., A. G. L., J. B. C., and others who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) F. J. S. says: 1. I want to make an induction coil 1 foot long. What number and what length of wire shall I use for the primary and secondary coils respectively? A. About 1½ or 2 lbs. of No. 36 for the secondary, and 150 feet of No. 14 or 16 for the primary. 2. Shall I keep each layer of the primary wire separated by placing something between the layers? A. A sheet of paraffin paper is sufficient. 3. Shall I keep each layer of the secondary wire separated? A. Better wind the secondary in two sections and exercise the greatest care in insulating. It is well to place the coils in melted paraffin until well saturated.

(2) J. R. says: 1. You show the misapplication of the word force in many instances but the word is used in a very slipshod manner when speaking of the force of gravity as applied to the atmosphere. All authors agree that the atmospheric pressure is about 15 lbs. on the square inch of the whole earth's surface. But this is not atmospheric pressure, but is the whole effect of gravity, including that of the air also. Gravity is known to extend to the moon and far beyond; whereas the atmosphere does not extend very far. At 45 or 50 miles height it is not dense enough to reflect the sun's rays. It is also asserted that a cubic foot of atmospheric air weighs only 535 grains, and is 820 times lighter than water. A. The pressure of the air is due to its weight; and though the weight of a single cubic foot is very small, the column of air producing the pressure is many feet in height. 2. What has become of the result of Venus' transit? A. The results of the transit observation have not yet been computed; and it will probably be at least a year before they are finished.

(3) W. S. says, in answer to many correspondents who have asked how to cut glass tubes: Take a small round file, break a little off the point to get a sharp edge, then insert it into the tube to where it requires to be cut, and scratch around the inside, when the other part of the tube will fly off instantly. In most cases the crack runs ahead of the scratch.

(4) A. J. L. says: Is steam turned directly on to lumber to dry it, or is it conveyed into a heater and the lumber dried from the heat generated? A. In the great majority of cases steam is used confined in pipes, and circulating to and from the boiler, thus heating the air in the room, and, by the circulation of the latter, drying the lumber. 2. I have a dry house, 14 x 16 feet, and would be glad to know if a ¾ supply pipe will be sufficient to convey steam to it? A. Yes, if arranged as above described and with a return pipe to boiler. See No. 6, p. 123, vol. 36.

(5) G. W. S. says: You give a recipe for paint made of Portland cement and sand. Is it for wood? Can it be used on a frame house instead of white lead and oil? A. It is only suitable for brickwork, stonework, or concrete walls.

(6) R. P. W. says: 1. Please give me your opinion of nitrous oxide gas. Is it safe to use in dental surgery? A. If the gas is made from pure nitrate of ammonia, and subsequently well washed in a solution of protosulphate of iron, it is one of the least objectionable and safest of known anæsthetics. If free from nitrous acid and chlorine, it may be administered without danger except in cases where there is already an over active circulation in the brain. 2. What are its effects? A. When inspired into the lungs, owing to its solubility, it is rapidly dissolved in the blood, and quickly diffused throughout the body. The transient intoxication which it causes is due to augmented oxidation produced in the system by the gas.

(7) J. T. H. asks: Please give me a recipe for staining wood a dark cherry red, a permanent and bright color? A. 1. Boil ½ lb. logwood in 3 pints of water, and add ½ oz. salt of tartar. Stain the wood with the liquor boiling hot. 2. Boil ½ lb. madder and ¼ lb. fustic in 1 gallon water; use hot, as before. 3. Boil 1 lb. Brazil wood and 1 oz. of washing soda in 1 gallon of water, apply hot, and then brush over it before dry, a solution of 2 ozs. alum in 1 quart of water.

(8) N. C. L. asks: 1. By what process are medals cast? A. Medals are usually stamped out by means of machinery similar to that employed in making coin. 2. How are stereotypes copper plated? A. The deposition of copper is obtained by electro-plating the form in a bath of sulphate of copper. 3. How can I prepare the plaster of Paris for stereotyping, so as to prevent airholes in the mould? A. Slightly but uniformly oil the face of the type, and then pour over it a thin cream of the plaster, which work well into the letters with a camel's hair brush. Then run the thicker plaster, and allow to set. Dry the cast well in an oven and, by means of a soft brush, uniformly coat the matrix with a film of black lead (plumbago).

(9) F. H. asks: If the temperature is at zero, and stays so for two weeks, and ice forms two feet thick in that time, if then you take two thermometers that indicate alike, place one on the ice, the back of it lying on the ice, and hang the other two or four feet above the ice; will they indicate the same after being there a little while? A. Yes, all the conditions being the same.

(10) J. W. R. asks: What is the best method of preventing heat in rooms in hot weather, under flat tin roofs where the center rises some 2½ to 3 feet? We are greatly discomforted in hot weather by the heat in our upper rooms; and we propose to put on another story with French roof, which will also be flat, or as much so as the present one. In doing this, how can the excessive heat be prevented in this new story? A. Inclose a space under the roof about 3 feet in height at the ridge and about 1 foot at the eaves, by hanging a cribbed ceiling from the roof beams. Provide a special flue in each chimney, opening by a stationary register, or by a number of small openings in the brickwork, near the top of this inclosed space, and provide similar openings to the exterior air under the eaves of the house, which latter openings will come near the bottom of the inclosed space. By this means a circulation of air may be secured under the roof that will keep the temperature nearly as low as that of the exterior atmosphere.

(11) F. P. F. says: I wish to use kerosene to make a liniment and for other purposes where the strong smell is objectionable. Is there any way to get rid of the smell without destroying the nature of the kerosene? A. By agitation for several days with powdered chloride of calcium, the disagreeable odor of the oil may be removed; but the oil cannot be completely deodorized.

(12) C. H. asks: 1. What size of wire is the best for winding a large electro-magnet of horseshoe shape to give it the most power? A. The size of the wire should be made to suit the battery used with it. Nos. 14 or 16 will probably answer your purpose. 2. How many cells (Daniell), each holding about 3 quarts, will be needed to make an electric light sufficient to light a room 50 x 100 feet? A. It is difficult to get a light with less than 40 or 50 Daniell cells, and they should be large, so as to give but little internal resistance. 3. How can I coat the inside of a large tin can with copper, so that it will not come off? A. By the battery process, after the usual cleaning. Place the solution in the can, connect the latter to the zinc of the battery and the copper of the battery to a copper plate in the solution. 4. How shall I make the carbon points for an electric light? I have coke carbon, but it is not of the right shape. A. It is better to buy them, but you can saw them out of coke taken from gas retorts if you have patience enough.

(13) C. V. W. asks: How can I clean a bronze statue? A. Rub it with a little oxalic acid solution and pipeclay, afterwards with a brush and tripoli powder.

(14) W. H. V. asks: 1. What is the best method of constructing a refrigerator or butcher's ice box? These boxes are generally about 9 feet long, 4 feet wide, and 6 or 8 high, and are built of tongued and grooved stuff, with 3 inches of sawdust between the outer and inner lining. What is the proper position for the ice crib? A. Near the top of the box. 2. Should the dripping pan be placed directly under the ice or not? A. It should consist of V-shaped gutters a little distance below the slots in the bottom of the crib, conveying the water away. 3. What will cause the cold air to circulate through the box? A. The air coming in contact with the ice will fall to the bottom of the box, and the warmer air will take its place, thus establishing a circulation. 4. Will a bottom of cement be any better than one of wood? A. No. 5. What is the best to put between the linings? A. Sawdust is good; but some have the interior of inclosing walls lined with paper pasted over the surfaces, and no other filling. We ought to say that many of the above devices are covered by a patent.

(15) G. W. asks: How can I unite vulcanite (in which artificial teeth are set) so as to make a durable joint that will resist the heat and moisture of the mouth? A. Dissolve 1 part of sulphur and 3 parts pure caoutchouc in 6 parts alcohol and 100 parts bisulphide of carbon, and evaporate to the consistence of a thin paste. Join the fractured edges with this, and heat the whole to about 310° Fah. for 4 hours.

(16) W. D. says: 1. I want to lay 1,000 feet of water pipe from soft water spring to house and barn. Which, lead, galvanized iron, or common iron pipe, is most durable? A. Galvanized iron pipe will be the most serviceable. 2. Is lead pipe dangerous on account of poisonous matter? A. If lead is exposed to the combined action of pure water and air, an oxide of lead is formed on the exposed surfaces which is dissolved by the water with which it is in contact. This solution is highly poisonous, as are all of the lead salts. The presence of chlorides or nitrates in the water assists this corrosive action, while it is retarded by the sulphates, phosphates, and carbonates. Bicarbonate of lime, a salt found in many spring waters, prevents this corrosion by depositing a coating on the exposed surfaces. In the use of lead pipes as conduits for drinking water, it should be carefully ascertained whether the water to be conveyed contains foreign matters, which will prevent its action upon the metal. 3. Should I plumb my house with iron water pipe and protect the pipe from cold by filling around the pipe with sawdust? A. Yes. The method is a good one. 4. Will iron pipe sweat and rust in the sawdust? A. It is difficult to keep such pipes perfectly dry in warm weather, even when protected as above. The pipes may, however, be in a great measure prevented from rusting by coating them with asphalt varnish.

(17) T. P. H. asks: What degree of heat is required to harden rubber in a vulcanizer, so as to answer for hand stamps? A. It requires a temperature of 260° Fah. There is no danger about it.

(18) J. E. S. says: If a locomotive pull a train of cars around a curve, I say that every one of the cars would bear the flange of its outer wheels against the inner side of the outside rail. A friend says the last five or six cars would not, because the train in front would be gone around the curve so far as to have a tendency to pull the rear part of the train against the inner rail. Who is right? A. You have about the right idea.

If I am 150 lbs. in weight, and fasten said weight to one end of a rope, and take hold of the other end, can I pull up any more than that weight over a single sheave, everything being in balance? I contend that I cannot pull up any more than 150 lbs. unless my feet were pinioned to the ground. Am I right? A. As we understand the question, you are right.

(19) E. H. A. says, in answer to correspondents who ask for a cure for chilblains: Dissolve 1 lb. alum in about 1 gallon of water, soak the feet or parts affected in the solution just before going to bed every night for from 5 to 8 nights, using the same water, and having it as warm as the flesh will bear easily. It will restore the flesh to its natural color and feeling.

(20) E. L. asks: Of what diameter or size should drills be to fit ⅛, ¼, ⅜, ½, ¾, 1 inch, and us to 4 inches pipe taps? A. Make the holes just so large that the end of the tap for each respective size will just enter the hole.

(21) B. W. L. asks: How is sulphuret of iron manufactured? A. Heat iron turnings to bright redness in a black lead crucible; and, while in this condition, throw in an equal weight of crude sulphur, in small pieces. The combination will take place immediately; and as soon as the sulphide formed is thoroughly fused, it should be poured out and covered with sand, to cool slowly.

(22) E. J. asks: Can rubber be made considerably hard and yet retain its flexibility and toughness, so as to bend quite short without cracking? A. Yes. There is vulcanized rubber in the market that will answer all your requirements.

(23) C. C. says: I have an emery wheel 1 foot in diameter, the hole of which is very rough and too large for the spindle. Could I run Babbitt or other metal in it and turn it out to fit the spindle to make it run true? A. Make a Babbitt metal bush, and insert it in your emery wheel. 2. How fast should it run for gumming saws? A. At about 4,000 or 5,000 feet of circumferential speed per minute. 3. How many teeth should a circular saw of 14 inches diameter have for ripping hard and soft wood? A. There is a difference of opinion upon this point. 4. Does hard wood need more teeth than soft wood? A. As a rule, yes. 5. What should be the size and length of journal for arbor of foot lathe for turning wood? A. Two and a half times the diameter of the arbor. 6. Would there be much difference in the necessary amount of power required to drive said lathe if two journals were used on said arbor instead of one? A. Not if properly adjusted.

(24) W. W. M.: Send for information about windmill to T. K. A., 22 East 12th street, New York city.

(25) A. T. N. asks: What solutions are used in coloring articles of horn or vegetable ivory? A. For black, lay the articles for several hours in a strong aqueous solution of nitrate of silver, and then expose to strong sunlight; or boil in a strong decoction of logwood and then in solution of acetate of iron. For blue, immerse for some time in a dilute solution of sulphate of indigo, partly saturated with potash. For green, boil in a solution of verdigris in vinegar. For red, dip the articles first in a tin mordant and then into a hot decoction of Brazil wood or cochineal. Scarlet, use lac dye instead of the preceding. Violet, dip in the tin mordant and immerse in a decoction of logwood. For yellow, impregnate with nitrohydrochlorate of tin and then digest in a strong decoction of fustic. The coal tar colors are now generally used for this and similar purposes.

(26) T. S. asks: What is chloroxynaphthalic acid ($C_{10}H_5ClO_3$)? A. Chloroxynaphochinone ($C_{10}H_5ClO_3$) is a yellow crystalline powder. Its salts are used as dyes. It may be obtained from any large dealer in the coal tar colors.

(27) J. H. asks: 1. Can I get an elastic rubber of a white or light tint? A. You can purchase such rubber as you mention. 2. Is there any way to bleach it? A. The rubber cannot be bleached by any ordinary means, but by the introduction of such bodies as chalk, sulphate of barytes, pipeclay, sulphide of zinc, etc., before vulcanization, an artificial whiteness may be produced in the rubber.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the result stated:

F. W.—No. 1 is basalt, containing crystals of iron pyrites (sulphide of iron). No. 2 contains chrysocolla, a hydrous silicate of copper, also a little malachite (carbonate of copper).—A. D. W.—It is a piece of flint containing crystals of iron pyrites. We found neither silver nor lead.—W. M. W. says: I send you herewith a box containing specimens of coal, with some white substance in the seams. Will you please inform me what it is, and whether it is of frequent occurrence? A. It is paraffin. We have had similar samples sent us before; but it is not of common occurrence.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On a Driver's Seat.
On Planetary Meteorology. By R. M.
On Hydrophobia. By M. G.
On Geographical Anatomy. By A. W.
On Spiritualism. By J. H. P.
On the Shape of the Earth. By W. E. B.
On the Lost Paradise. By C.
On Lightning Rods. By J. H. P.

Also inquiries and answers from the following:

A. S.—A. S. G.—W. M. M.—P.—H. T.—J. K.—T. W.—W. R.—J. D.—J. B. D.—J. H.—B. L.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who sells roller skates? Who sells the best foot lathe, with circular and jig saw attachments? Who sells file-cutting machinery, and what does it cost? Who sells vanadium? Who sells substances for preventing boiler incrustation? Whose varnishes are the best for carriage builders' use?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

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INDEX OF INVENTIONS

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[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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9,746.—RUBBER ERASERS.—C. B. Dickinson, B'klyn, N. Y.
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9,752, 9,753.—CARPETS.—T. J. Stearns, Boston, Mass.
9,754 to 9,756.—EMBROIDERY.—Emil Crisand, New Haven, Conn.
9,757.—WATER FONT AND BOX.—J. W. Fiske, N. Y. city.
9,758.—STOVES.—R. A. Culter *et al.*, Peoria, Ill.
9,759.—RUBBER SHOES.—J. Pienovi, Newark, N. J.

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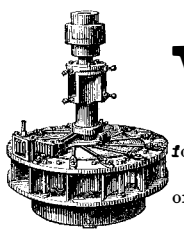

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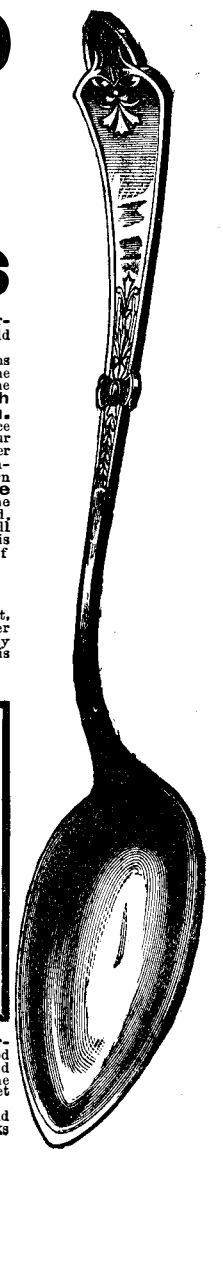

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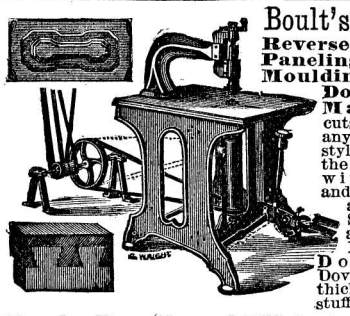

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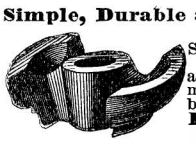

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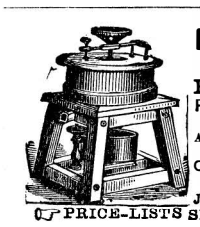

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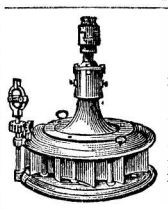

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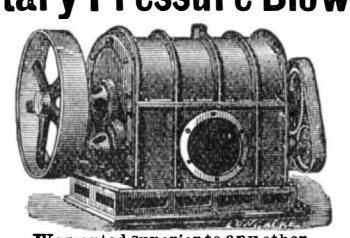

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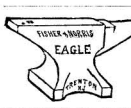

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Retail Price, 9 Cents per lb.
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$3 Press for cards, labels, envelopes, etc. Large sizes for large work. *Anybody* can work them, have good pastime for spare hours, and can **make money** by taking in small jobs.
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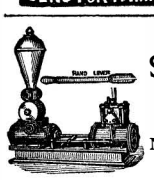
MANUFACTURED BY BURLEIGH ROCK DRILL CO.
SEND FOR PAMPHLET. FITCHBURG, MASS.



Niagara
Steam Pump Works.
ESTABLISHED 1826.
CHARLES B. HARDICK,
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NON-COMBUSTIBLE STEAM BOILER AND PIPE
COVERING
WITH "AIR SPACE" IMPROVEMENT.
Saves 10 to 20 per cent. CHALMERS SPENCE CO., Foot E. 9th St. N. Y.; 1202 N. 2d St., St. Louis, Mo.

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The fact that this shafting has 75 per cent. greater strength, a finer finish, and is truer to gauge, than any other in use, renders it undoubtedly the most economical We are also the sole manufacturers of the CELEBRATED COLLINS' PAT. COUPLING, and furnish Pulleys, Hangers, etc., of the most approved styles. Price list mailed on application to JONES & LAUGHLINS,
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☞ Stocks of this shafting in store and for sale by
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STEAM PUMP WORKS,
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Great reduction in prices. Send for catalogue. The "Knowles" has always been the best steam pump made.

PUNCHING PRESSES. Drop Hammers and Dies, for working Metals, &c. THE STILES & PARKER PRESS CO., Middletown, Conn.

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Machines AND Wheels Guaranteed.

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This article is now well known in all parts of the country as the only reliable standard, low-priced Roofing. It is furnished in rolls ready for nailing to the roof, weighs only about 60 pounds to 100 square feet, and when finished with the **Fire-Proof** Asbestos Coating, presents a handsome white or light-gray surface. It is adapted for steep and flat Roofs in all climates, costs only about half as much as Tin, and can be readily applied by any one.

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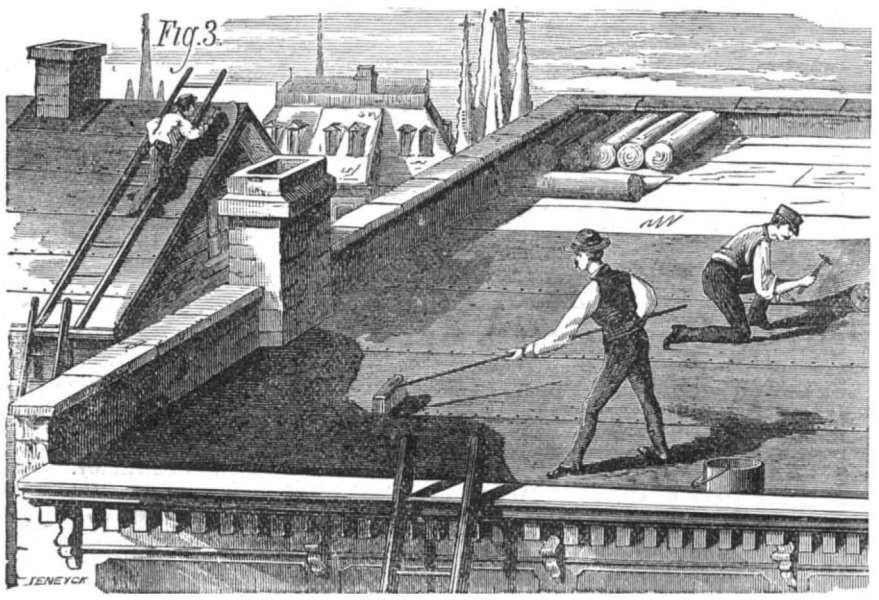

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This is a better article than has ever before been offered for this purpose. It contains no tar or cheap oils and forms the handsomest and most durable preservative coating in use for tin and other roofs, iron-work, fences, out-buildings, etc. It is furnished ready for use in packages of all sizes.

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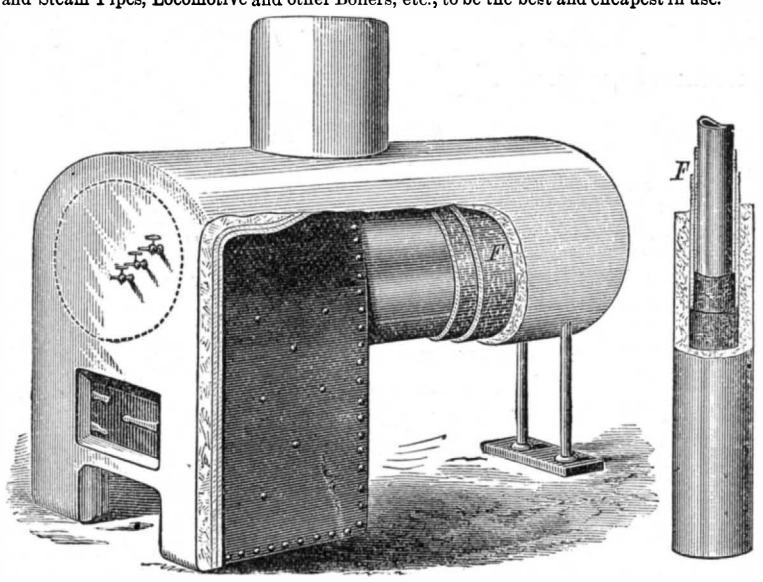
The most durable and effective non-conductors in use—proved superior to all others in U. S. Government tests—a perfect insulator for hair felts, rendering them indestructible.

Asbestos Cement Felting (in barrels), **Asbestos Lining Felt** (in rolls 6 to 42 inches wide), **Asbestos Lined Hair Felt.** We guarantee these improved NON-CONDUCTING COVERINGS for Hot-Air and Steam Pipes, Locomotive and other Boilers, etc., to be the best and cheapest in use.



ASBESTOS STEAM PACKING.

Made from pure long-fibre ASBESTOS. Self-Lubricating; Indestructible. Will save ten times its cost in the one item of repacking, besides requiring less oil than any other packing in use. Loose, Flat, and Round, all sizes.

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All these materials are prepared ready for use, in neat and compact form, are suitable for all climates, and can be easily applied by any one. Liberal inducements to General Merchants, Dealers, and Large Consumers.

☞ Our goods are in use by the following, among thousands of other well known parties: T. Kingsford & Son, Oswego Starch Factory, Oswego, N. Y.; E. Remington & Sons, Ilion, N. Y.; Denison Paper Mfg Co., Mechanic Falls, Me.; Amoskeag M'f'g Co., Manchester, N. H.; Old Colony Iron Co., Taunton, Mass.; A. & W. Sprague & Co., Providence, R. I.; Cheney Bros., Silk Mfrs., So. Manchester, Conn.; Garner & Co., Print Mfrs., Haverstraw, N. Y.; Passaic Rolling Mill Co., Paterson, N. J.; Miller, Thomas & Co., Building Materials, Akron, O.; Aultman & Taylor Mfg. Co., Mansfield, O.; Comstock, Castle & Co., Quincy, Ill.; East Pennsylvania Iron Co., Lyons, Pa.; Kinney, Haley & Co., Yarmouth, N. S.; C. B. Record, Iron Mfr., Moncton, N. B.; N. Y. *Herald*, Harper Bros., P. Lorillard & Sons., A. T. Stewart & Co., New York city.

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Schlenker's New Machine Revolving-Die.
Send for Catalogue, giving prices and full description.
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$5 to $20 per day at home. Samples worth $5 free. STINSON & CO., Portland, Me.

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WM. L. CHASE & CO.,
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Pyrometers, For showing heat of Ovens, Hot Blast Pipes, Boiler Flues, Super-Heated Steam, Oil Stills, &c.
HENRY W. BULKLEY, Sole Manufacturer,
149 Broadway, New York.

A. S. CAMERON'S
PATENT
"SPECIAL" Steam Pump
Is the Standard of Excellence at home and abroad.

REDUCED PRICE LIST.

Number.	PRICE.	Steam Cyl.	Pump Cyl.	Stroke.
0	$ 50	3½ in.	2 in.	4
1	75	4	2½	6
2	100	5	2½	6
3	150	6	3	7
4	200	7	3½	7
5	275	8	3½	10
6	325	8	4	10
7	400	10	5	12
8	425	10	5	12
9	480	12	7	12
10	550	14	9	15
11	700	16	10½	15
12	850	18	12	18

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Incombustible Mineral Wool
The best and cheapest insulator of heat or cold. Send for circulars, 26½ Broadway, New York.
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The HOADLEY PORTABLE STEAM ENGINE.
WITH AUTOMATICAL CUT-OFF REGULATOR AND BALANCED VALVE.
THE BEST & MOST ECONOMICAL ENGINE MADE
SEND FOR CIRCULAR.
The J. C. HOADLEY CO. LAWRENCE, MASS.
STATE WHERE YOU SAW THIS.

PATENT FOR SALE.—A NEW AND VALUABLE PATENT OF A **STEAM TRAP.**
Address T. MERKENBECK,
South Brooklyn, N. Y.

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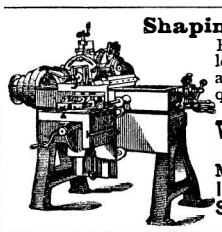

Have novel device for changing length of stroke while in motion, also, automatic down feed, and quick return. Four sizes.
Patented 1868, 1871, 1874.
Wood & Light Machine Co.
Worcester, Mass.
Manufacturers of all kinds of **Iron Working Machinery Shafting, Pulleys, &c.**

COMMON SENSE CHAIRS AND ROCKERS. Solid comfort all around the house. Send stamp for Illustrated Price List to F. A. SINCLAIR, Mottville, N. Y. For sale by the *Trade.*

STEAM ENGINES

Clipper Vertical Engines, off and on Wheels.
Price, on wheels, 6-horse power, $485; 8-horse, on wheels, price $700. *Dry Steam* Horizontal Engines, 8-Horse Power Climax, on wheels, $925. Builders of Stationery Engines, 4 styles, from 6 to 200-horse power. Corliss Engines, Extra Finish and Cut-off Engines, Crank Stationary and Plain Finished Engines, Boilers, Circular Saw Mills, etc.
Successors to Utica Steam Engine Co., formerly Wood & Mann. Established 1857.
We have the *largest* line Engine Patterns in United States. Good, responsible Agents wanted.
TAYLOR MANUFACTURING CO.,
Westminster, Maryland.

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